73 AMATEUR RADIO®

International Edition

MARCH 1989
ISSUE #342
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A WGE Publication

Home-brew:

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More CB to 10m!
Easy feed-point protection

Reviews:

Hand-held TNC
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Compact 80m antenna
Cliff-dweller's RF ground

PLUS:

CW for computerniks
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145.3 10.0 -9.9 13
ICOM
144MHz ALL MODE TRANSCEIVER IC-275A

ICOM HAS ALL YOUR BASES COVERED

ICOM has your winning line-up for fixed, portable, and mobile operations on today's hottest amateur bands. Slide into the winner's circle with ICOM's deluxe "75" series transceivers, with a team committed to excellence from VHF to UHF communications. Each compact all-mode unit delivers maximum performance, reliability, and ease of operation. It's a championship line-up!

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SUPER SCANNING Monitor all of today's action with four scanning modes: spectrum, programmable, mode, and memory. Scans 99 memories in five seconds!

2 METERS. ICOM's 25-watt **IC-275A** VHF leader receives 138.0-174.0MHz including the public service, marine, and weather bands, and transmits 140.1-150.0MHz. Includes AC supply. The **IC-275H** is 12-volt DC-powered, produces 100 watts output, and will operate with external AC supply. Two of ICOM's heavy hitters!

IC-575A
6 Meter/10Meter Transceiver

IC-475A/H
440MHz Transceivers

IC-375A
220MHz Transceiver

IC-275A/H
2 Meter Transceivers

220MHz. The 25-watt output **IC-375A** receives 216.0-236.0MHz, transmits 220.0-225.0MHz, and includes AC supply. A genuine masterpiece!

440MHz. Enjoy top-notch 430.0-450.0MHz operation with the 25-watt **IC-475A** featuring AC supply, or go high power using the 75-watt, AC/DC-powered **IC-475H** "super rig."

6 METERS/10 METERS. Join the fun of sunspot cycle 22 openings with the superb 10-watt **IC-575A**. It receives 26-56MHz, transmits 28-29.7MHz, and 50-54MHz, and includes AC supply. The **IC-575A**, a true superstar!

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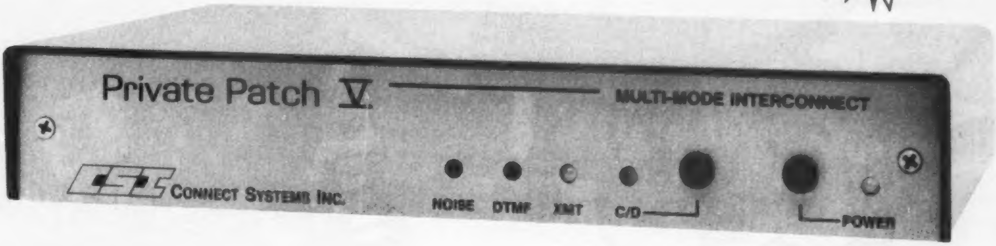
FOUR user selectable operating modes and a 90 number autodialer make Private Patch V the ONLY choice!

NEW!



SELECT AN OPERATING MODE USING THE BUILT-IN KEYBOARD . . .

1. SIMPLEX SAMPLING PATCH

Private Patch V achieves a level of sampling patch performance unobtainable in any other product. Crucial to performance is the noise squelch filter. Compare our five pole filter to the competition's two pole filter. Advanced software algorithms perform noise correlation tests which result in greater useable range than the competition. Nine selectable VOX enhancement ratios allow you to vary performance from straight sampling to highly VOX enhanced. (sampling rate decreased while the land party is speaking). The mobile is in full control and can break-in at any time.

2. SIMPLEX VOX PATCH

VOX mode offers superb simplex operation with any radio, including synthesized and relay switched models. VOX mode has other advantages too. 1. A linear amplifier can be used to extend straight simplex range. 2. You can operate through any remotely located repeater to greatly extend range. 3. If desired you can connect Private Patch V to the MIC and speaker jack of your radio. NO INTERNAL CONNECTIONS ARE REQUIRED. Control is maintained automatically with built-in dial tone detection, busy signal detection and fully programmable activity and time out timers. An optional electronic voice delay board eliminates first word clipping with slow switching radios.

3. DUPLEX PATCH

Select duplex mode when connecting Private Patch V to your existing repeater or duplex base station. Many features including semi-duplex privacy mode are user programmable. The mobile is in full control at all times.

4. REPEATER CONTROLLER

Private Patch V will convert any receiver and transmitter into an outstanding performing repeater with duplex autopatch. Features such as repeater on/off code, hangtime, activity timer time, CW ID interval etc. are fully user programmable. Private Patch V is the right choice for your club system.

Private Patch V is a totally new concept in automatic phone patches. A built-in keyboard and menu driven display allow you to customize all modes, features, and functions specifically to *your application.*

Private Patch V can be a sampling patch today. A VOX patch tomorrow. And a repeater controller next year!

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- Auto disconnect on dialtone/busy signals
- Telephone remote base
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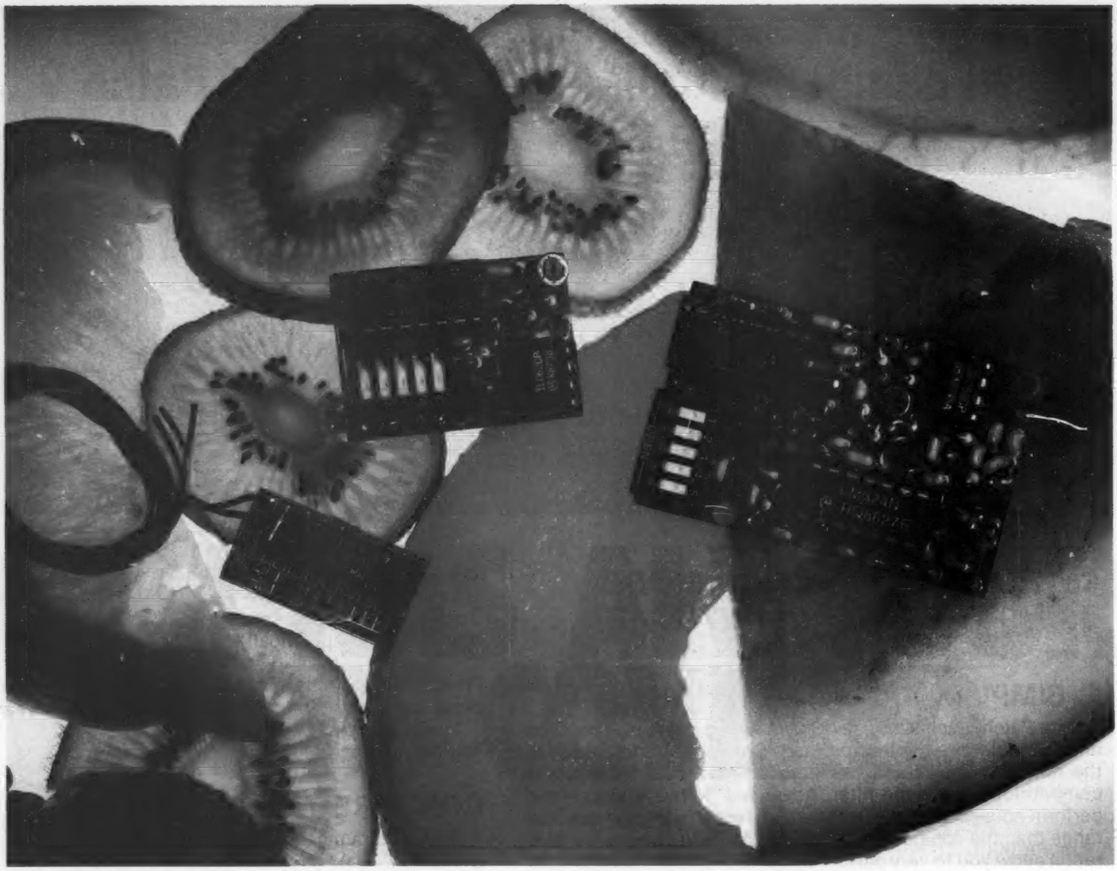

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Cover: Heath's new pico-sized TNC—the HK-21
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MFJ TUNERS

Here is the finest 3 KW PEP Tuner money can buy with roller inductor, dummy load, *new* peak reading meter, antenna switch, balun and more ...

MFJ VERSA TUNER V
TRANSMITTER
ANTENNA SELECTOR
ANTENNA
INDUCTOR
METER
LAMP
POWER

The MFJ-989C is not for everyone. **However,** if you do make the investment you get the finest 3 KW PEP tuner money can buy - one that will give you a lifetime of use, one that takes the fear out of high power operation and one that lets you get your SWR down to absolute minimum.

The MFJ-989C is a compact 3 KW PEP roller inductor tuner with a new **peak** reading Cross-Needle SWR/Wattmeter. The roller inductor lets you get your SWR down to absolute minimum.

With **three continuously** variable components - two massive 6 KV capacitors and a high inductance roller inductor - you get precise control over SWR **and** the widest matching range possible from 1.8-30 MHz.

You get a **new** lighted **peak** and average reading Cross-Needle SWR/Wattmeter with a **new** more accurate directional coupler.

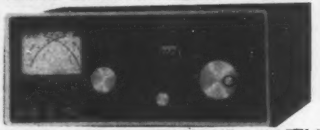
You get a giant two core balun wound with teflon wire for balanced lines and a 6-position antenna switch with extra heavy switch contacts.

Its compact 10¾x4½x15 inch cabinet fits right into your station.

You get a 50 ohm 300 watt dummy load for tuning your exciter, a tilt stand for easy viewing and a 3-digit turns counter plus a spinner knob for exact inductance control. Add $10 s/h.

MFJ-989C **$349.95**

2-knob *Differential-T*™ Tuner



MFJ-986 **$269.95**

The **new** MFJ-986 Differential-T™ 3 KW PEP 2-knob Tuner has a differential capacitor to make tuning foolproof and easier than ever. It ends constant retuning with broadband coverage and gives you minimum SWR at only **one** best setting. Covers 1.8-30 MHz.

The roller inductor lets you tune your SWR down to absolute minimum. A 3-digits turns counter lets you quickly return to your favorite frequency.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp is front panel switched and requires MFJ-1312, $9.95.

A **new** current balun for balanced lines reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced for a more concentrated, stronger signal. Add $10.00 s/h.

MFJ's *Fastest Selling* Tuner

MFJ-941D **$109.95**

The MFJ-941D is MFJ's fastest selling 300 watt PEP antenna tuner. Why? Because it has more features than tuners costing much more and it matches everything continuously from 1.8-30 MHz.

It matches dipoles, vees, verticals, mobile whips, random wires, banlanced and coax lines.

SWR/Wattmeter reads foward/reflected power in 30 and 300 watt ranges. Antenna switch selects 2 coax lines, direct or through tuner, random wire, balanced line or tuner bypass. Efficient airwound inductor gives lower losses and more watts out. Has 4:1 balun. 1000 V capacitors. 10x3x7 inches.

MFJ's *Random Wire* Tuner

MFJ-16010 **$39.95**

CAPACITANCE
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MFJ ANTENNA TUNER

You can operate all bands anywhere with any transceiver when you let the MFJ-16010 turn any random wire into a transmitting antenna. Great for apartment, motel, camping operation. Install a wire anywhere! Tunes 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 in.

MFJ's *Best 300 Watt* Tuner

MFJ-949C **$149.95**

The MFJ-949C gives you more precise matches than any tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

You also get MFJ's lighted 2-color Cross-Needle SWR/Wattmeter, 6-position antenna switch, 50 ohm 300 watt dummy load and a built-in balun - all in a compact 10x3x7 inch cabinet that fits right into your station. Meter light requires MFJ-1312, $9.95.

With MFJ's **best** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliability.

MFJ's *Mobile* Tuner

MFJ-945C **$89.95**

Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

You can **operate anywhere in a band and get low SWR.** You'll get maximum power out of your solid state or tube rig and it'll run cooler and last longer.

Small 8x2x6 inches uses little room. **SWR/ Wattmeter and convenient placement of controls make tuning fast and easy while in motion.** 300 watts PEP output, efficient airwound inductor, 1000 volt capacitors. Mobile mount, MFJ-20, $3.00.

144/220 MHz VHF Tuners

MFJ-921 **$69.95**

MFJ's new VHF tuners cover both 2 Meters and the 220 MHz bands. They handle 300 watts PEP and match a wide range of impedances for coax fed antennas. SWR/Wattmeter. 8x2½x3 in. **MFJ-920, $49.95.** No meter. 4½x2½x3 inches.

MFJ

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MFJ's *Artificial* RF Ground

$79.95 **MFJ-931**

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. The MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** -- no matter how far away it is -- by tuning out the reactance of your ground connection wire.

Barefoot/1.5 KW Linear Tuner

MFJ VERSA TUNER III

MFJ-962C **$229.95**

For a **few** extra dollars, the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. Covers 1.8-30 MHz.

You get two husky **continuously** variable capacitors for maximum power and minimum SWR. And lots of inductance gives you a wide matching range.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp is front panel switched and requires MFJ-1312, $9.95.

Has 6-position antenna switch and a teflon wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14 7/8 inches. Add $10.00 s/h.

MFJ's *smallest* Versa Tuner

MFJ-901B **$59.95**

TRANSMITTER

The MFJ-901B is our smallest -- 5x2x6 inches -- (and most affordable) 200 watt PEP tuner --when both space **and** your budget is limited. Good for matching solid state rigs to linears.

It matches whips, dipoles, vees, random wires, verticals, beams, balanced and coax lines from 1.8-30 MHz. Efficient airwound inductor. 4:1 balun.

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VOLUME
SPEED
MFJ ELECTRONIC KEYER PADDLE
MFJ PACESETTER
MFJ ELECTRONIC KEYER PADDLE

MFJ-422B

$129⁹⁵

The best of all CW worlds - a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Bencher iambic paddle!

This MFJ Keyer is small in size but big in features. You get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 V battery or 110 VAC with MFJ-1305, $9.95.

The keyer mounts on a Bencher paddle to form a small (4 1/8 x 2 5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

America's favorite paddle, the Bench, has adjustable gold-plated silver contacts, lucite paddles, chrome plated brass, and a heavy steel base with non-skid feet.

You can buy just the keyer assembly, MFJ-422BX, for only $79.95 to mount on **your** Bencher paddle.

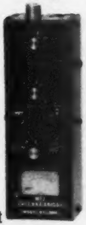
Artificial RF Ground

MFJ-931
$79⁹⁵

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** - no matter how far away it is -by tuning out the reactance of your ground connection wire. 7½x3½x7 in.

Antenna Bridge

MFJ-204B
$79⁹⁵



Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

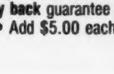
No other equipment needed - take it to your antenna site. Determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built-in resistance bridge, null meter, tunable oscillator-driver (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter, $9.95.

Super Active Antenna

'World Radio TV Handbook' says MFJ-1024 is "a first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise factor... broad frequency coverage ... excellent choice."

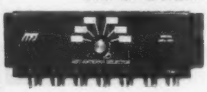
Mount it outdoors away from electrical noise for maximum signal, minimum noise. MFJ-1024 covers 50 KHz to 30 MHz

Receives strong, clear signals from all over the world. 20 dB attenuator, gain control. ON LED Switch two receivers and aux. or active antenna. 6x23x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. 12 VDC or 110 VAC with MFJ-1312, $9.95.

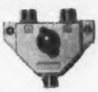


MFJ-1024 $129⁹⁵

MFJ Coax Antenna Switches



$34⁹⁵ MFJ-1701



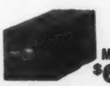
$21⁹⁵ MFJ-1702

New
$59⁹⁵ MFJ-1704

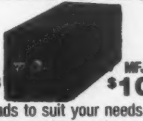
Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. They come with MFJ's one year **unconditional** guarantee.
MFJ-1701, $34.95. Six position antenna switch. SO-239 connectors. 50-75 ohm loads. 2 KW PEP, 1 KW CW. Black aluminum 10x3x1½ inch cabinet.
MFJ-1702, $21.95. 2 positions. Cavity construction. 2.5 KW PEP, 1 KW CW. Insertion loss below .2 dB. 50 dB isolation at 450 MHz. 50 ohm. 3x2x2 in.
MFJ-1704, $59.95. 4 position Cavity Switch with Lightening/Surge protection device. Center Ground position. 2.5 KW PEP, 1 KW CW. Extremely low SWR. Isolation better than 50 dB 500 MHz. Negligible loss. 50 ohm. 6¼x4¼x1¼ in.

"Dry" Dummy Loads for HF/VHF/UHF

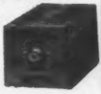
MFJ-260
$28⁹⁵



MFJ-262
$69⁹⁵



New
MFJ-264
$109⁹⁵



MFJ has a full line of dummy loads to suit your needs. Use a dummy load for tuning to reduce needless (and illegal) QRM and save your finals.
MFJ-260, $28.95. Air cooled, non-inductive 50 ohm resistor. SO-239 connector. Handles 300 watts. Run full load for 30 seconds, derating curve to 5 minutes. SWR less than 1.3:1 to 30 MHz, 1.5:1 30-60 MHz. 2½x2½x7 in.
MFJ-262,$69.95. Handles 1 KW. SWR less than 1.5:1 to 30 MHz. 3x3x13 in.
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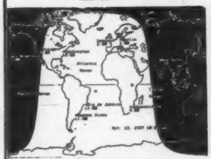
MFJ-1286 Gray Line DX Advantage

New
$29⁹⁵ MFJ-1286



Snag rare DX for only $29.95! The MFJ-1286 is a computerized DXing tool that predicts DX propagation. Even the casual DXer can work rare DX by knowing when conditions are best for DX. The Gray Line is the day/night divider line where the most amazing DX happens every day. Now you'll know **exactly** when to take advantage of it.

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For Kenwood, Icom, Yaesu, Santec

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MFJ's compact Speaker/Mics let you carry your HT on your belt and never have to remove it to monitor calls or talk.

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MFJ-284 fits Icom, Yaesu. Santec. **MFJ-286** fits Kenwood.

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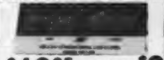

$19⁹⁵ MFJ-108B $9⁹⁵ MFJ-107B

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MFJ-815
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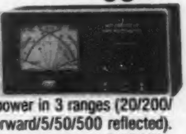

MFJ Cross-Needle SWR/Wattmeter shows you SWR, forward and reflected power in 3 ranges (20/200/2000 watts forward/5/50/500 reflected). Push button range selection. 1.8-30 MHz.

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Deluxe Code Practice Oscillator

New

MFJ-557
$24⁹⁵

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Also portable because it runs on a 9 volt battery (not included) or an AC adapter ($9.95) that plugs into the side.

Earphone jack for private practice. Tone and volume controls for a wide range of sound. Speaker. The key has adjustable contacts and can be hooked to your transmitter. Sturdy. 8½x2¼x3¾ in. One year **unconditional** guarantee

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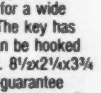

Prevent damage to rig, computer or other gear. Monitor AC line voltage for potentially damaging surge/brown out conditions on 2-color expanded 95-135 volt scale.

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Welcome, Newcomers!

AMATEUR RADIO DEMYSTIFIED

Welcome to Amateur Radio! Since you're reading this, chances are you've just gotten your amateur license, or are seriously thinking about it.

Like any technical hobby, however, ours is full of techspeak, acronyms, and jargon which can really put off a newcomer. Before I got my "ticket" (Amateur Radio license), I had learned some Morse code. When I tuned on an amateur band on my old Philco radio for nice slow code, however, and copied it, less than one-tenth of it was comprehensible! I knew I wasn't dyslexic, discounted Alzheimer's disease because of age (18), and was told by a native that it wasn't Czech. I resigned myself to the fact that Amateur Radio had its own language and I had to learn it.

Fortunately, there were fellow hams around me who wouldn't let me believe that it was hard, and, after a short time, I was having too much fun to notice. A week after getting my ticket, I made my first international contact in Morse code, with a schoolteacher south of Sao Paolo, Brazil. Contacts with Argentina, Finland, Japan, and Australia ensued, and ham jargon and acronyms showed themselves to be the link between people with no other common language, a kind of radio Esperanto. These once off-putting words and symbols became bonding ones; the system which at first restricted me became a liberating one.

You will hopefully have the company of enthusiastic hams like I did to ease your entry into the hobby. Meanwhile, use the following format as a key into our fascinating world.

Anatomy of a Contact

Most ham contacts follow a standardized format, and there are good reasons for it. Mike fright—not knowing what to say—is a common problem. Many new hams besides you, and not just a few veterans, suffer from it. This isn't surprising when you consider that you're meeting someone for the first time and are still unfamiliar with the equipment, and many of us are naturally shy. It really helps to be able to start off with a protocol which soon becomes automatic. This lets you think about what you're going to say next while tuning your antenna, making final tuning adjustments on your equipment, etc.

To Call

First tune to a clear frequency, making sure that it is in within your license class restrictions. Then, to be sure, call "Is this frequency in use from (your callsign)?", or send "QRL?" Allow 5–10 seconds for a response. Repeat this procedure. If there's no response, call or send the letters "CQ" ("seek you") 6–8 times followed by your callsign, twice. If you're on voice, and conditions are poor, give your callsign phonetically, e.g. "this is 'November-Sierra-One-Bravo'" for NS1B. There are several common phonetics for each letter which you will soon get to know.

Joe Ham will respond by first giving your callsign several times, followed by his callsign. If conditions are poor, he may then say "Do you copy?", or send "QSL?", and wait for you to respond with "I copy," or "QSL." If conditions are better, Joe will probably just continue with a little about himself after responding to your call.

A Little About Joe

We have a tendency to forget to give details about ourself which we consider boring because we repeat them with each new contact. We need to remind ourselves that these details helps the other person identify with us. To keep ourselves in line, we continue to follow a format.

Joe goes on by giving his name, prefaced in CW (Morse code) by "NAME IS..." He then says/sends "QTH is..." followed by his location.

At this point, he will likely tell/send you your signal report. Code reports in CW have three parameters—"Readability, Strength, and Tone"—and are prefaced by "UR RST IS..." In practice nowadays on CW, only the first two characters ("Readability" and "Strength") vary much, since most rigs produce an excellent CW tone. "9" is often shortened to "N", e.g. an RST of "599" is sent "5NN." Voice contact reports are two characters, "Readability" and "Strength." It is often given with an "and" in between; e.g. "5 and 9."

After this, Joe then says "How Copy?", or sends "QSL?" and you take up the mike/key and repeat exactly his transmission format.

After this, it's your choice what to talk about. Many a ham's next step is to describe his station (My rig is..., my antenna is thus and so and is up "X" number of feet, etc.). If you're familiar with Joe's QTH, you can talk about it; if you're not familiar with it, you can still talk about it. Tell'em about your other hobbies, and ask him about his. Ditto for work, family, books read, movies seen, places visited, etc. The list of topics is endless. After the contact, you'll wonder why you ever had mike fright!

Finishing the Contact

A good wrap-up puts a nice cap on a contact. A procedure to follow helps keep the contact from ending too abruptly or dragging out.

The hardest part for most is being the first to say you have to QRT (end the contact). Once that hump is hurdled, you turn the mike to him. He thanks you for the contact and turns it back to you. You then thank Joe for an excellent contact, say "73"(some prefer "73s"), and tell him you "will QSL" (send a card of acknowledgment), and will look for his. You then say "Over to you for your final (words), Joe." He will return and say "Thanks again and 73s. This is (his callsign), clear." You finish your transmission by saying "This is (your callsign), clear."

Remember, these patterns aren't cast in stone—they're meant only to get you started! Good luck!

...de NS1B

"Q" SIGNALS

The language of Amateur Radio is riddled with strange three-letter words beginning with "Q"—you may have noticed that four of our monthly departments are titled with'em.

They first came into being in the Morse code-only days as a way to reduce common questions and statements to a short code and so make communications more efficient. "Q" was likely chosen as the first letter because it's the least common letter in the alphabet, and in normal use is almost always followed by "U"—if "Q" was followed by anything else, it was a sure bet that it was a code.

The "Q"-signal system's *practical* use is more and more dated now with the plethora of highly reliable modes, but it remains rooted in a ham's vocabulary. "Q" signals can be either questions or statements. Here are the most common ones, followed by an example:

QRL—"Are you busy? I am busy." Send this to see if a frequency is clear.
QRM—"Is my transmission interfered with? Your transmission is being interfered with." Often said "Q-R-Mary" to distinguish it from QRN.
QRN—"Are you troubled by static? I am being troubled by static." Often said "Q-R-Nancy."
QRP—"Shall I decrease power? Decrease power." There are some hams devoted to elegance of low-power operation. Mike Bryce WB8VGE devotes his QRP column to these enthusiasts.
QSB—"Are my signals fading?" "My signals are fading." Often said "Q-S-Baker." "There's a lot of QSB on the band."
QSL—"Do you copy me, do you acknowledge?" "I copy, I acknowledge." Hams exchange QSL cards to verify their contacts with each other. See "QSL of the Month" next to the Never Say Die column for colorful and imaginative examples of these.
QSO—Conversation. "Thanks for the QSO, old man."
QSY—"Shall I change frequency?" "Change frequency." "Let's QSY to another frequency."
QTH—Location. "My QTH is Peterborough, NH."
QRX—"When will you call me again?" "I will call you at (hours) on (frequency)." Our QRX column is devoted to Amateur Radio news.
QRT—"Shall I stop sending?" "Stop sending." "Dinner's on the table, I must QRT."

JUST PLAIN JARGON

What's a language without fun words and endearments? Following is a list of a few of ours. (Again, most date back to the CW-only days.)

DX-Long Distance—What is considered "long-distance" varies according to what band you are operating on, and at what power level.
OM - "Old Man."—Man of any age.
YL - "Young Lady."—Unmarried woman of any age.
XYL - "Ex Young Lady."—Wife. The "Ex" doesn't imply that she instantly ages upon marriage, just that she is no longer unmarried!
Harmonics —Children of the OM and the XYL.
88 (variant: **88s**) —Hugs and kisses.
73 (variant: **73s**) —The very best to you! Enjoy our magazine!

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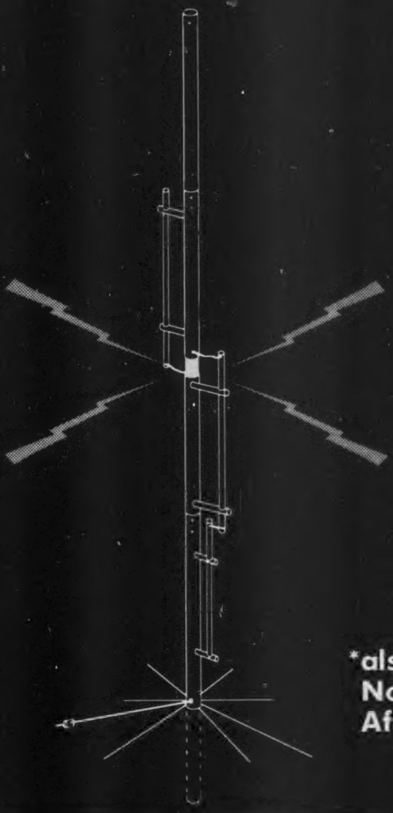
  Top —Ctr Nominally 3.9 mhz



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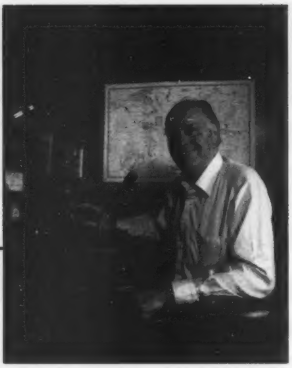
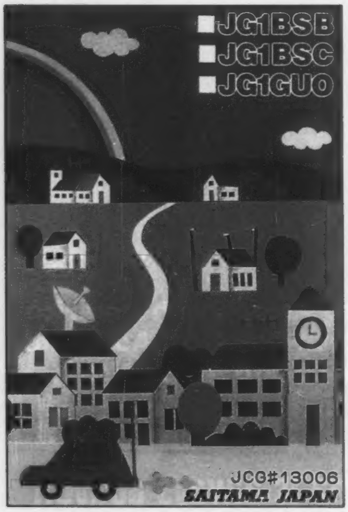


220 Is NOT Dead!

The imminent removal of the bottom two megahertz of the 220 band to make room for United Parcel doesn't exactly put the band out of commission. The fact is this won't seriously affect most 220 operations.

I bring this up because the ham dealers tell me that the sales of 220 gear have virtually stopped, apparently in a panic over-reaction by hams who have heard that the FCC is taking away the 220 band, but haven't bothered to read the details. Frankly, I can't think of a much better way to make sure the FCC starts thinking we don't need the 3 MHz we have left. We're still in a use-it-or-lose-it world, so if we stop using 220, why shouldn't we lose it?



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Please pass the word to the panic-stricken that 220 is not lost, only the relatively unused end is going away. That won't bother most repeaters. Sure, we're going to have to make some room for a handful of weak-signal fanatics—probably up between the repeater inputs and outputs. For most 220 ops there will be little or no noticeable change.

One of the reasons the FCC went after 220 was the general perception that the band is little used. This isn't quite true, but most of the groups using 220 have been so secretive about their work that little has appeared in the ham magazines. This has, in turn, kept interest in the band down and given most hams (and the FCC) the impression that 220 is almost completely unused... a real wasteland.

In amateur radio, as in academia, it's publish or perish. If you do anything unusual on 220 you'd better take the time to write about it to a ham magazine, or, like the falling of a tree in the forest when there is no one there to hear it, questions will arise about whether anything has actually happened.

If your club doesn't have a PR person whose job it is to make sure that the world knows about the club's activities, you're part of the problem, not the solution. A club PR person should let the local papers, TV, and radio know about any club events like Field Day, contests, hamfests, special speakers.

If the club has a 220 repeater open for Novices, has the word been spread? I'd love to have you let *73* know about it. And if you have any special features, like a cross-band function so they can work some DX on 10 meters via 220, that's news.

I've been asking for club photos for several years. I can't remember the last time a club got together for a group photo and sent it in. The Japanese ham magazines run up to a hundred pages a month of club photos. This helps the clubs and helps generate more interest in amateur radio.

If this conspiracy of secrecy about amateur radio continues, we're going to have a harder and harder time attracting new hams. Sure, the QRM on 20 meters will eventually go down. Well, the QRM from hams will go down, but you know as well as I that the QRM from foreign government and commercial stations will quickly fill in any vacuum we leave.

So let's get busy and make sure that what little we're doing on 220 is known. Get some articles into *73* on anything unusual you're doing. Make sure your repeaters are listed. Get some pictures of 220 groups into *73*. 220 will be a lot more real if it isn't left as a phantom band.

NIAC Is Growing

NIAC, the nonprofit National Industry Advisory Committee, now has 17 paid industry-supporting firms and groups! NIAC's purpose is to provide an interfacing group between amateur radio and the FCC. Membership is $100, that goes entirely for an action newsletter and FCC meeting expenses (not including any expenses for participants).

The main goal for NIAC is to promote the growth of amateur radio—for the good of the hobby and for our country.

Continued on page 60

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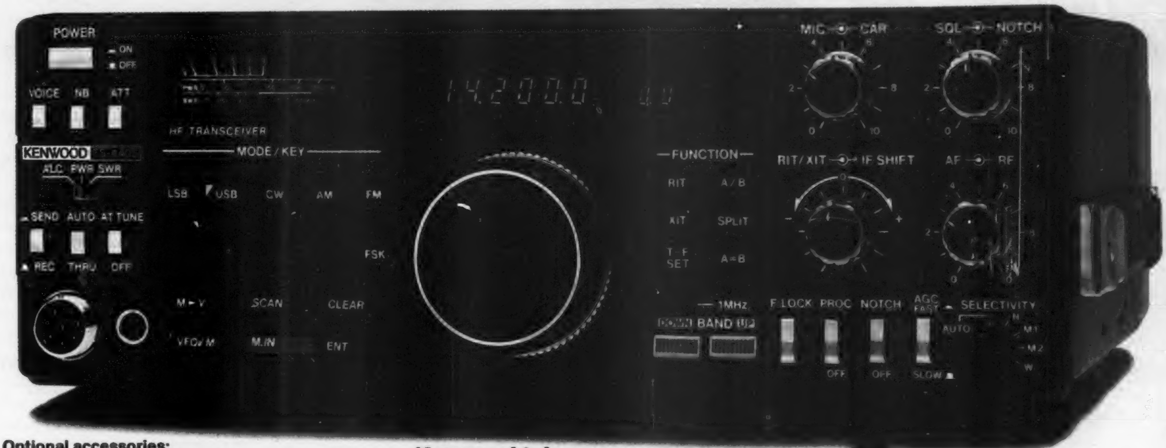
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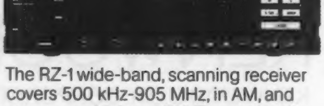
The R-5000 is a high performance, top-of-the-line receiver, with 100 memory channels, and direct keyboard or main dial tuning—makes station selection super easy! Other useful features include programmable scanning, large, built-in speaker, 110 volt AC or 12 volt DC operation (with optional DCK-2 cable), VHF capability (108-174 MHz) with the VC-20 option, dual 24-hour clocks with timer, and even voice frequency readout with the VS-1 option.

RZ-1
Wide-band scanning receiver



The RZ-1 wide-band, scanning receiver covers 500 kHz-905 MHz, in AM, and narrow or wideband FM. The automatic mode selection function makes listening easier. One hundred memory channels with message and band marker, direct keyboard or VFO frequency entry, and versatile scanning functions, such as memory channel and band scan, with four types of scan stop. The RZ-1 is a 12 volt DC operated, compact unit, with built-in speaker, front-mounted phones jack, switchable AGC, squelch for narrow FM, illuminated keys, and a "beeper" to confirm keyboard operation.

Optional Accessory
• **PG-2N** Extra DC cable

R-2000

The R-2000 is an all band, all mode receiver with 10 memory channels and many deluxe features such as programmable scanning, dual 24-hour clocks with timer, all-mode squelch and noise blankers, a large, front-mounted speaker, 110 volt AC or 12 volt DC operation (with the DCK-1 cable kit), and 118-174 MHz VHF capability with VC-10 option.

Optional Accessories
R-2000:
• **VC-10** VHF converter • **DCK-1** DC cable kit for 12 volt DC use.
R-5000:
• **VC-20** VHF converter • **VS-1** Voice module • **DCK-2** for 12 volt DC operation • **YK-88A-1** AM filter • **YK-88SN** SSB filter • **YK-88C** CW filter • **MB-430** Mounting bracket.
Other Accessories:
• **SP-430** External speaker • **SP-41** Compact mobile speaker • **SP-50B** Mobile speaker • **HS-5** Deluxe headphones • **HS-6** Lightweight headphones • **HS-7** Mini-headphones.

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Specifications, features, and prices are subject to change without notice or obligation.

Number 3 on your Feedback card

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

U3MIR Now On The Air!

Cosmonauts Vladimir Titov U1MIR and Musa Manarov U2MIR returned safely to earth on 21 December at 2157 UTC, ending their year-long stay in outer space on *Mir*. Vladimir and Musa made amateur radio history as the first to operate a ham station station aboard an orbiting space station. They made hundreds of contacts with terrestrial amateur stations.

On 19 December, during *Mir* orbit 16305, Musa said farewell to all hams. The 2 meter FM station remained aboard, and is now operated by Dr. Valeri Polyakov, using the call U3MIR. It appears, however, that Valeri speaks only Russian. At this time, AMSAT-NA has no information about the operating times of U3MIR.

Hams worldwide thank Musa and Vladimir for this first in amateur radio. We thank Musa especially for his initiative and determination in getting a station aboard *Mir* and getting licensed—all done while in space.

Armenia

"73 International" Soviet correspondent, Gennady "Gena" Kolmakov UA9MA, has been very actively involved in the Armenian relief effort. Gena arrived at Leninakan, Soviet Armenia on 11 December to provide communications support for the relief effort. Ed NT2X, managed to contact him at that location on the 19th, though the path was very noisy and Gena was operating only 100 Watts into a dipole. Though their contact was sketchy, Gena managed to transmit the brief statement: "Ed, I saw things you could not imagine." Look for a full report from Gena in an upcoming "73 International."

Commendations also go to Ed who has handled hundreds of pieces of H&W traffic between Armenia (via UG7GWO) and the US.

Cranston

US Senator Alan Cranston distributed a letter to hams in California that suggests the FCC might reverse its decision to reallocate the 220 to 222 MHz band to land mobile use. In his November 29th message, Cranston says he contacted the commission and learned that the FCC is reconsidering the reallocation action. This comes as no surprise since the FCC has on file almost *700* petitions from hams who want the reallocation cancelled.

Youngest Extra?

Sandi Saunders is yet *more* proof that neither code nor theory need keep you away from getting your ticket. Sandi got her Novice ticket (KC4AJO) at age eight in May 1987, and has since steadily marched her way up to Extra Class. She passed the theory exam for the highest license at the July '88 Atlanta hamfest, and the code section several months later. Age when she became Extra-Class: 10 years, 3 months. Sandi's the harmonic of Dean AA4XL and Ruth N4NVX.

All-County First?

Ken Wosika KB7QO of Las Vegas may well be the first ham to have transmitted mobile from all counties in the US. How many did you catch him in?

Stay In Band!

A reminder to all the 10 meter enthusiasts that the FCC does not permit phone operation below 28.3 MHz. IARU band plans in all regions protect beacons at 28.2–28.3 MHz from regular two-way operations, and all amateurs should avoid operating phone below 28.3 MHz, even outside of the US where such operation might be permitted by the licensing authority (e.g., Canada).

Digital Radio

What comes after AM and FM radio? Digital Modulation, or DM. In the United States, National Public Radio (NPR) called on the FCC to allocate a new broadcast band for DM. NPR says: "It does not seem likely that advanced radio systems incorporating digital techniques will be fully exploited using existing AM or FM bandwidths. . . therefore, new spectrum is almost certainly required."

DM offers more more faithful conveyance of digital signals, such as those that come from compact disc players. The problem, though, is that digital reception is either 100% perfect or non-existent. As with current AM or FM, there can be "holes" or "shadows" in coverage areas, under bridges, and behind tall buildings. Multipath, in which different phases of the same signal arrive at a receiver, can also be a problem. Richard Lambley of *Electronic and Wireless World* magazine offers a solution to this.

The new service would be wideband, with 16 stereo channels scattered over 4 MHz of spectrum space. This band would be cut into some 450 narrow carrier frequencies. The 16 digital channels would be scattered across all these frequencies, using a system called "Orthogonal Frequency Division Multiplexing with Convolutional Coding." This should eliminate fading and "radio shadows."

If part of the signal disappears, it can be filled in from the carriers on other frequencies, which are likely affected differently. Finding a free allocation in the already crowded radio bands may be the biggest problem. Engineers would like to see the digital system assigned to frequencies somewhere between 500 and 2000 MHz, an extremely popular part of the spectrum.

17 Meters

A group of US hams with experimental licenses now transmit on 17 meters. They hold regular skeds on Saturdays and Sundays at 1900 UTC on 18.111,

$$ HOME-BREW IV $$

73 Magazine again invites all home-brewers to turn their hot solder into cold cash and prizes, and to get their name in print to boot. All projects have a chance to appear in the magazine, and we will handsomely reward the authors of the best of these.

Now for the bounty. Ramsey Electronics sweetened the pot from their line of frequency counters. First prize is $300, a 10-year subscription to *73*, and a CT-125 1.25 GHz frequency counter. Second prize is $150, a two-year sub, and a CT-90 600 MHz frequency counter. Third prize is $75, a two-year sub, and a CT-70 525 MHz frequency counter. All this is in addition to the payment every author receives for publishing in *73*.

Contest Rules

1. Entries must be received by 1 April 1989.
2. To enter, write an article describing your best home-brew construction project and submit it to *73*. If you've never written for *73*, send an SASE for a copy of our Writer's Guide, or download it from CompuServe (Hamnet forum, Library 0., filename "73WRIT"). *Be sure to state on the submission that it is for the Home-brew IV contest.*
3. Here's the real challenge: The total cost of your project must be under $73, even if all the parts were bought new. Be sure to include a detailed parts list with prices and sources.
4. Our technical staff will evaluate each project on the basis of originality, usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original. That is, they must not be published elsewhere. There is no limit to the number of projects you may enter.
6. All purchased articles become the property of *73 Magazine*.
8. Mail your entries to:

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Peterborough, NH 03458-1194
Attn: Home-Brew IV

Continued on page 14

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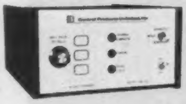
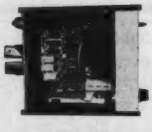


GMS 403
(3 Program Slots)



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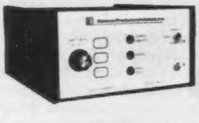

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CIRCLE 342 ON READER SERVICE CARD

QRX . . .

Continued from page 11

in addition to impromptu midweek skeds. Recently the skeds were expanded to additional tests at 1600 UTC. This group includes Bill Orr W6SAI (KM2XDW) in California, Stu Cowan W2LX (KM2XDU) in New Hampshire, Fred N0CAO (KA2XAE) in Missouri, Bob Stankus WS4I (KB2XCQ) in Virginia, and Phil Galasso K2PG (KA2XUK) in New Jersey. [*On 17 meters the experimental callsigns are used.–Ed.*] FCC regulations permit two-way contacts only between experimental stations, but the group, involved in a propagation study of this band, welcomes signal reports from any and all listeners. They have already collected reports from various DX locations and from across the US. The mailing address for QSN reports is: Fred A. Sontag, P.E., Lake Farm, RT 1 Box 86, Tebetts, MO 65080.

A little hot-air balloon mobile, anyone? These low-fliers were at last year's Dayton show.

Emergency Reminder

Health and Welfare traffic does *not* carry emergency priority. Many operators didn't realize this during emergency communications in the aftermath of Hurricane Gilbert. During these operations, 20 meter emergency nets were seriously hindered from passing priority messages, such as relief supply information, because of H&W traffic.

The main difference between H&W and emergency priority is that the latter concerns the whole relief effort, whereas the former concerns an individual or small group of individuals. On-air clarifications about this were difficult at best, though, because by the time net control finished explaining, a new raft of H&W stations rolled in on frequency.

Ham Radio-Based Curriculum

Through the efforts of the Council for the Advancement of Amateur Radio in the NYC schools, a curriculum bulletin entitled "Amateur Radio in the New York City Schools" is nearly complete, according to Martin Smith KA2NRR, President of the Council, who heads the team. Team members included Joe Fairclough WB2JKJ, Jeff Feigenbaum KA2KSW, Al Misunas WB2RLQ, Rich Wolfert WB2EYI, and Len Zuckerman KB2HK. The New York City Board of Education's office of Media and Telecommunications, under the supervision of project coordinator Jerry Eisenberg K2CFG, is now reviewing and editing the bulletin.

The curriculum guide, funded by a $7,000 grant, will have a total of 50 pages of sample elementary and secondary level lessons in different subjects, strategies for organizing school activities, a bibliography of useful materials, and a recent source listing of radio clubs and speakers available in the New York City area. One thousand copies will appear in late fall for distribution. The Council also plans an in-service course for teachers for the spring school term.

Out Of The Fog-M

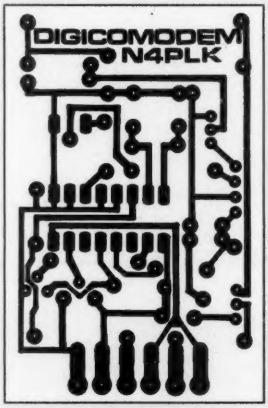
The US Army's use of the 70 cm band in Northern Alabama for testing a new missile system concluded 16 December, according to Army spokesman Bob Hubbard. Amateurs using the 420–450 MHz band observed weekday quiet hours since October to facilitate this experiment, which involved airborne sensors for testing FOG-M, a fiber optic guided missile. Amateurs share the 70 cm band in Northern Alabama with the military. Voice repeaters and packet trunks in Huntsville were among the amateur systems affected during the quiet hours. The Muscle Shoals Amateur Radio Club also took its packet system off the air. Hubbard says he knows of no cases of interference during the testing.

Tompkins is SK

One of the most noted writers in the world of amateur radio, Walker A. Tompkins K6ATX, passed away on Thanksgiving Day, in Santa Barbara, California. Tompkins was best known for his series of Tommy Rockford Ham Radio Adventure Books.

Inflation

All TCM 3105 modem home-brewers take note. The printed circuit board foil diagram shown on page 43 of last month's issue is 115% of actual size. Please use the actual-size foil diagram below. We apologize for the inconvenience.



Whose Idea Was It, Anyway?

Fred Maia W5YI tendered his resignation as a director of the newly formed National Amateur Radio Association. Maia cited the reason for this as the widespread misconception that the drive for a code-free entry level license originated with NARA and not with him. The Dallas publisher says that the no-code initiative is his alone, and that NARA is only one of a broad base of supporters made up of industry, and concerned amateurs and non-amateurs.

NARA is currently headed by Don Stoner W6TNS.

Thanx!

To all who contributed news items to this month's QRX column. They are: *Westlink, Federal Communications Technews, Sweden Calling DXers, BNT Bulletin, The North Florida ARS Balanced Modulator,* Fred Sontag N0CAO, ARRL Hudson Division, David Black KB4KCH, and AMSAT-NA News Service. Keep your news items and photos rolling in!

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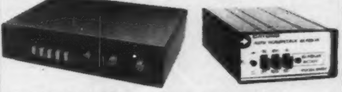

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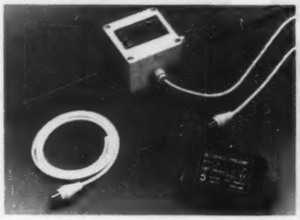

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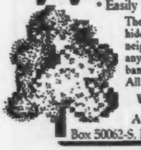

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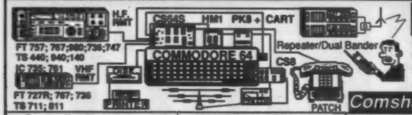

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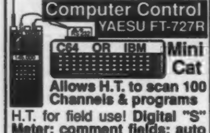

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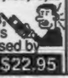

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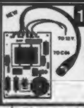

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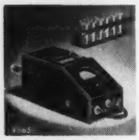

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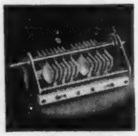

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WRITE OR CALL FOR OUR COMPLETE CATALOG

Control Head for the TS-440S

Convenient mobile HF operation.

by Wesley E. Rader WB0UVN

Do you have a Kenwood TS-440S with the VS-1 voice synthesizer, or are thinking of buying one? Do you have an interest in mobile HF? If you answered "Yes"to both questions, this article is for you! It shows how to build a very small control head for the front seat of your car (Photo A) which allows you to remote your TS-440S, such as to your trunk!

Materials

A shielded 12-conductor cable gives you access to controls and information on the TS-440S. The control box is a 1⅛" x 2⅛" x 3¼" plastic box from Radio Shack. It contains controls for on-off/volume, frequency up-down control, PTT, and voice synthesized frequency announcement; and a 2" speaker. This covers everything you need to operate the TS-440S mobile!

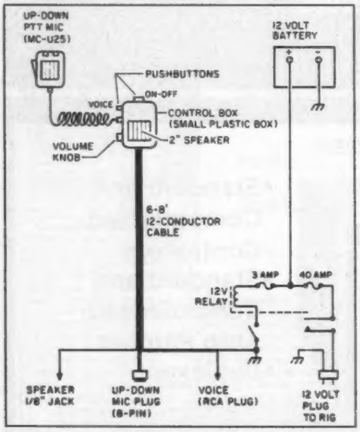


Figure 1. Wiring for the control box and TS-440S mobile installation. A 12 volt relay supplies 12 volts, 20 amps to the TS-440S. Fuses protect the rig.

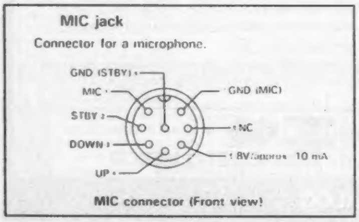


Figure 2. Mike pin configuraton for the TS-440S.

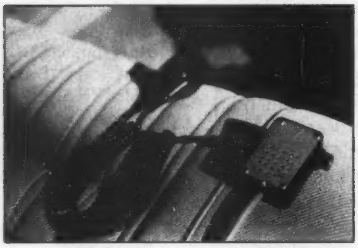


Photo A. A control head for the front seat of your car to access your Kenwood TS-440S in the trunk.

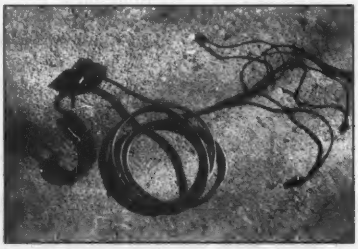


Photo B. The control box/cable assembly.

Construction

There is only one mod needed on the rig, besides installing the VS-1 voice synthesizer. This mod allows you to activate the voice synthesized frequency read-out from the control box. You first must open up the 440S and find "J54" on the control panel circuit board (X53-1450-00 [B/2]). You will see that a pair of wires go from pins 3 and 4 of "J54" to the voice synthesized frequency read-out control. Attach two new wires to pins 3 and 4 and run these to the ACC-3 RCA jack on the back panel of the rig. This allows an external RCA plug to control the voice module. This is then taken through the cable to the control head. Do not ground the outer part of this plug.

After obtaining the cable and parts, solder the plugs: (1) a 12 volt, 2-prong plug; (2) the 8-pin microphone jack; (3) the voice, RCA male jack; and (4) the ⅛" speaker jack, to the end of the cable that will be in the trunk of the car with the TS-440S (Photo B).

There are many other possible combinations of plugs and switches. Be creative!

Cable Line Routings

The ON-OFF switch on the volume pot turns on a 12 volt relay that supplies 12 volts at 20 amps to the TS-440S. Fuses also protect the rig. (See Figure 1.)

The voice button (RCA jack to ACC-3 circuit board on the rig) activates the frequency read-out.

The up-down microphone jack is an 8-pin jack. (See Figure 2.)

The speaker port is a ⅛" jack.

At the other end of the cable, attach the plastic box and solder in the OFF-ON part of volume pot, the voice button, and the up-down and PTT 8-pin microphone speaker and volume pot.

The arrangement of the controls is up to you.

Operation

How simple can it be? Use the up-down microphone buttons to choose the frequency of the band you preset, or select one of the 100 memory frequencies and modes, or even split frequencies, such as for 10 meter FM repeater work, depending on what your mobile antenna will handle. One touch on the voice button verifies in-band frequency. Push the PTT switch to talk. Simple! Happy HF mobiling!

Parts List

Quantity	Description	Part Number
1	6 to 8-foot shielded 12 conductor cable with one internal shielded wire for microphone (if possible, surplus video cable).	
	Control Head	
1	1⅛" x 2⅛" x 3¼" plastic box	RS 270-230
1	8-pin microphone jack (female)	
1	miniature volume control with OFF-ON switch	
1	2" speaker	RS 40-245
1	voice button, momentary on-push	RS 275-1547
	Rig End	
1	⅛" male speaker jack	RS 274-287
1	8-pin microphone jack (male)	
1	RCA male jack	RS 274-384
2	12 volt, 2-prong plugs; 1 male, 1 female	RS 274-202
1	12 volt relay and socket	
1	3 amp fuse and holder	
1	40 amp fuse and holder sufficient wire from 12 volt source to relay and fuses.	

Number 5 on your Feedback card

Switching for Older RF Amps

Connect your old amp to your new HF rig.

by Bill Clarke WA4BLC

Several months ago I wrote an article that gave instructions for building a relay switching adapter inside the Heathkit SB-200 linear amplifier so that it could be used with modern solid state transceivers. (See "Modernizing the SB-200," in the August issue of *73*.)

Since then, many readers have asked me if it is possible to adapt that scheme to older amplifiers. The answer is yes, and the instructions follow.

Why the Need?

At most hamfests, and in the ham classified ads, you will find older linear amplifiers at bargain prices. Such examples are Hallicrafters, Bandit, SBE, Swan, and National. Many use the popular 3-500 tube(s), but most are not directly compatible with modern transceivers. These older amplifiers have keying circuits using voltages much higher than the allowable low-current 12-volt DC relays found in today's solid state transceivers. If you attempt to directly key an older amplifier with a new transceiver, you most likely will damage that internal relay (mechanical or solid state). Repair will cost at least fifty dollars.

Building an External Relay

Here's how to build a small external relay interface box that will connect any solid state HF transceiver to an old amplifier. The interface box is built of parts from Radio Shack. Part numbers are given in the Parts List.

The unit not only controls the keying of the amplifier, but includes status lights and a bypass switch as well. You can build it for less than twenty dollars in a single evening. If you have some of the items in your junk box, the project will be even cheaper. If you have 12 volts DC available, you will not need the 12 volt DC adapter. This would save you $10.95.

Construction Details

Open and disassemble the interface unit's plastic case. Mark the positions for the pilot lamps (2) and the switch (1) on the face plate. The lamps should be 1" horizontally from each side, and centered vertically. The switch is centered in both directions. Drill ½" holes for the lamps and a ¼" hole for the switch.

Install the lamps and the switch, being careful not to mar the case front. Hold the terminal strip in the center of the rear panel and mark the positions of the mounting holes. Using a drill of the same diameter as the strip's holes, drill holes into the panel to match those on the strip. Mount the strip with suitable nuts and bolts. An alternate method of attachment is to use epoxy glue or hot glue.

Drill a ½" hole immediately above the terminal strip.

Mount the relay on the inside of the rear panel with epoxy glue or hot glue.

Wire the unit as indicated in the schematic or pictorial diagrams. Pass the wires from the lamps, switch, and relay through the rear panel (½" hole) to the terminal strip and attach them to the upper screws of each terminal. You will use the lower screws for power and radio or amplifier connections.

Testing Instructions

Hook up 12 volts DC to terminals 3 and 4. Terminal 3 is negative and terminal 4 is positive.

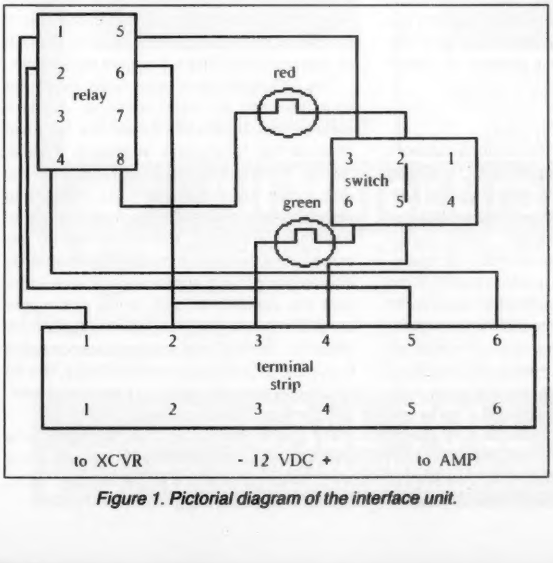


Figure 1. Pictorial diagram of the interface unit.

Push the switch to the right. The green light should come on, indicating the unit has power. If not, recheck your wiring.

Short terminals 1 and 2 together. You should hear an audible click as the relay closes, and the red light should come on. If not, recheck your wiring.

Using a VOM, or continuity checker, check terminals 5 and 6 for open circuit when only the green light is on; check them for closed circuit when the red light is also on. If not, recheck your wiring.

Using the Interface

Turn your interface box, transceiver, and amplifier off before proceeding.

Connect a pair of wires from terminals 1 and 2 to the control outputs of your transceiver. Refer to your operator's manual for information specific to your rig. The connections will be NO (normally open) and closed when the PTT line or VOX is activated. Terminal 2 of the interface's terminal strip is the circuit ground, if your transceiver uses a grounded/shielded type of plug. In most cases polarity is not a consideration.

Connect a pair of wires from terminals 5 and 6 to the keying inputs (relay control) of your amplifier. Polarity is not a consideration.

Turn your transceiver and amplifier on. After the equipment has warmed to operating temperature, key the transmitter. The amplifier should not key and no lights should be lit on the interface.

Turn the interface on and the green lamp will light, indicating power on. Press the transceiver's PTT (transmit) switch and the red lamp will light, indicating relay closure. At the same time the amplifier will key.

Follow your amplifier's tuning instructions before keying it for more than a couple of seconds at a time.

When you don't wish to use your amplifier, turn the interface off.

Be Considerate

For the sake of the rest of us using the ham bands—please, only use your amplifier when necessary to maintain communications. When you need the extra few dB, though, rest assured you can safely drive your older amp with you newer rig! ■

PARTS LIST

Part#	Part	Price
275-213	relay	$3.99
275-662	switch	$3.19
272-332	red lamps	$1.69
272-337	green lamps	$1.69
274-659	6 position terminal strip	$1.59
270-250	plastic case	$4.99
273-1652	12 VDC adapter (optional)	$10.95

Number 6 on your Feedback card

73 Review

by A. Leigh Hawkes VE1GA

The ISOTRON 80

80-Meter antenna for cliff-dwellers.

Bilal Company
137 Manchester Dr.
Florissant CO 80816
Price Class: $66

Many radio amateurs live in areas where there is often a lack of space for traditional antenna designs, or where antennas are forbidden by restrictive covenants. With typical ingenuity and inventiveness, many hams have home-brewed clever antenna systems to accommodate these circumstances. However, for those not wishing, or not having the resources, to home-brew a restricted space antenna, there is now a commercial offering from the Bilal Company—the ISOTRON.

Unique HF Antenna

Resembling a slightly oversized bird feeder, the ISOTRON 80 is one of the most unique HF antennas I've encountered in nearly a quarter century of hamming. Manufactured of tempered aluminum, PVC, and cast acrylic, the ISOTRON unit's basic form consists of a fashioned aluminum top and bottom plate, with a coil assembly of approximately 4.5 inches in diameter mounted between them. Included are supporting insulators, mounting brackets, and tuning bars which adjust the antenna to resonance in the required portion of the band.

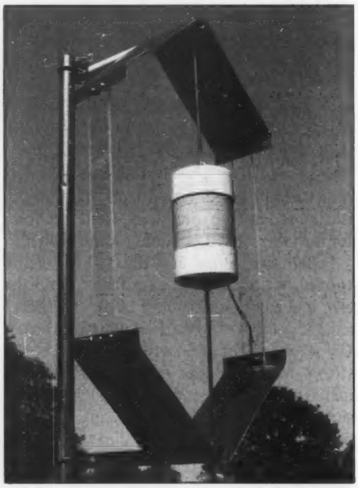
The ISOTRON stands just 35 inches high with a depth of 15 feet (including mounting brackets) and a width of 23 inches. It is rated at 2 kW PEP, produces an omnidirectional pattern, and is coaxially fed through the familiar SO-239 connector. Specified bandwidth is 110 kHz user-adjustable to any portion of the 80/75 meter band.

Assembly

Shipped in kit form, the ISOTRON comes with a full set of assembly and tuning instructions. The step-by-step instructions and several pages of pictorial drawings serve well to answer questions about parts identification and how the pieces fit together. Including time to check each part and read each step twice, I assembled the unit in less than thirty minutes. A word of caution: the aluminum top and bottom plates as well as the capacity hats have **very sharp** edges and corners. Depending upon the antenna's final location, it may be prudent to smooth off these edges and round off the corners of the capacity hats.

Tuning

A comprehensive set of tuning instructions accompanies the antenna. This is necessary because, as with any shortened or restricted space antenna, tuning tends to be very sharp. Any change in the antenna's environment can have a pronounced effect on tuning. A list of approximate settings is given for operation in various portions of the band.



The Isotron 80 antenna. Ideal for restricted space installation.

You need only an SWR bridge to tune the antenna. The instructions thoroughly describe a method of determining the antenna resonant point by using nothing other than "hand capacity" and the station receiver. You tune it by adjusting the tuning bars attached to either side of the top plate. These bars look like two small arms. Add or delete these bars, and the capacity hats that attach to them, according to the part of the band in which you wish to operate. Rotate the arms from the vertical to the horizontal position to obtain minimum SWR.

Field Test

I conducted tests with the antenna outdoors in a typical city lot. I mounted the ISOTRON on a pole ten feet above ground and used a half-wave inverted vee for comparison measurements. In this configuration, tuning varied somewhat from the approximate measurements given. Bandwidth in which the SWR did not exceed 2:1 was measured at close to 90 kHz. This compares well to the 110 kHz specification, which notes that environmental effects are to be expected. Height above ground and surrounding objects have a **very pronounced** influence on this antenna. At the test height, this also included rain. During a moderately heavy rainstorm, the ISOTRON, which had previously been operating with an SWR of under 1.5:1, became completely unusable, with the SWR rising to beyond 3:1. A check showed that the antenna coil assembly drain was clear. The problem was thus attributed to ground conductivity changes exaggerated by the low antenna height.

In operation the ISOTRON 80 performed beyond expectations. Received signal levels were generally about two "S Units" below the inverted vee. This had the pleasant effect of lowering several sources of local noise, thereby making it easier to copy the desired signals. I received transmit signal reports from a number of stations across the Atlantic Provinces. All indications are that the ISOTRON was performing similar to what might be expected from a mobile station.

Comments/Observations

When it comes to operating from a restricted space, no two locations are the same and they are not likely to produce the exact same conditions. The ISOTRON's size lends itself well to chimney, fence post, balcony, stairwell, closet, spare room, and attic, etc., mounting configurations. Each location, be it indoors or outdoors, will present its own unique conditions. Interaction with the surrounding environment can produce both positive and negative effects. Expect tuning and performance to vary.

Narrow bandwidth, reduced radiation efficiency, and sharp tuning are tradeoffs you can expect from a restricted space antenna, compared to a half-wave dipole. In return, the ISOTRON allows operation on a band that might otherwise be unavailable to the operator. Yes, this is a compromise. But, for many of us with few alternatives, it's quite acceptable.

The ISOTRON 80 is not a replacement for your full-sized 80 meter antenna, nor is it meant to be. (Unless of course, your full sized antenna has temporarily yielded to the elements. At times like this an ISOTRON in the attic could be a nice backup.) When and where space constraints preclude the use of traditional antennas, the ISOTRON 80 deserves consideration. If mounted outdoors, its unique design and appearance is sure to attract the attention of both family and neighbors. Comments have ranged from curiosity to affection. Its small size and appearance seem to make it at least acceptable to those who do not usually take delight in the beauties of traditional amateur radio antennas.

My special thanks to Carl VE1BQO, who graciously assisted with this review, and to his XYL, who gave the ISOTRON the "XYL Stamp of Approval."

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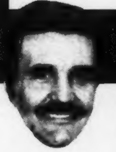

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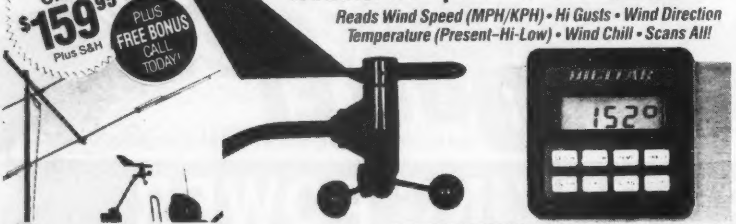

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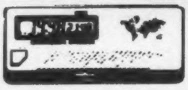

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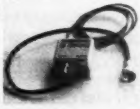

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Typical rejection:
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±5 Mhz@450 Mhz: −50dB

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Link Controller for the S-COM 5K Repeater Controller

Repeater linking—cheaply!

by Allan Overcast KF7FW

Would you like to have a repeater of your own, but you can't afford the luxuries of remote programming, selected access, and linking? A new repeater controller has hit the market that skillfully fulfills two of the three requirements: remote programming and selected access. The third luxury, repeater linking, only comes with high-priced repeater controllers, right? Wrong! The S-COM 5K repeater controller, priced at $189, is the perfect piece of equipment to upgrade your repeater's controller. With this low-cost link controller project, you can expand your system into a two-link prioritized controller.

The Heart of the System

The inexpensive S-COM 5K repeater controller is the heart of the system. With it, you can program all functions of the repeater remotely, using either the control receiver or the main repeater receiver as the communications medium. Included in its operations are three logical inputs, three logical outputs, priority control receiver ports, and a PL tone input. You can create macros, which are "small programs." Macros allow you to simplify operation; a couple of keystrokes will execute a sequence of commands. Once you have programmed these simple keystrokes to execute the sequence, you no longer have to remember the longer sequence. This feature also allows you, the control operator, to keep secret sensitive commands. Only you know the macros you've created and what they will do. With all of these features available for such a small price, any repeater organization can afford to upgrade their repeater to a fully automatic microprocessor-based system.

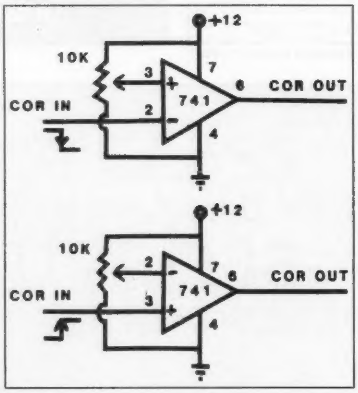

Figure 2. Receiver COR circuit.

Construction of the Link Controller

Keeping to the low current needs of most repeater systems, the link controller is designed completely around CMOS devices. Along with the need for low current was the need for user-friendliness. You can observe all functions of the link controller by adding an optional plug-in LED display board which communicates all major functions.

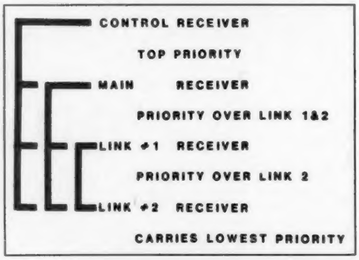

Figure 1. Receiver voting scheme.

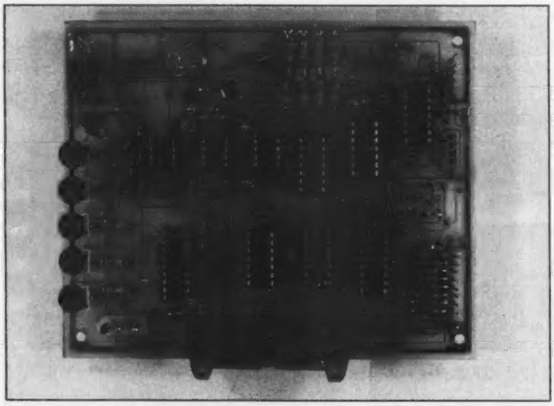

Photo A. The '5K Link Controller.

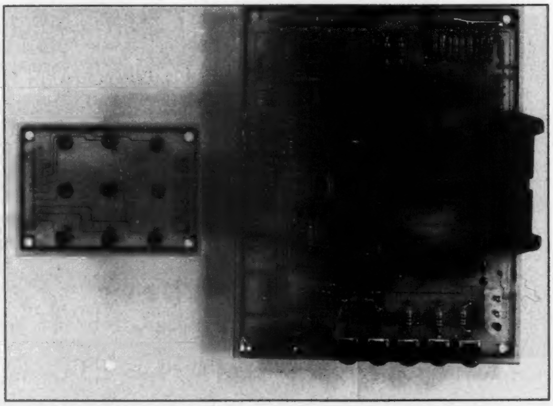

Photo B. The Main Controller Board and the optional LED display panel.

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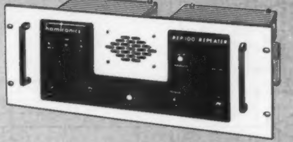
WIRED $975
VHF OR UHF



FEATURES:

- **SENSITIVITY SECOND TO NONE! GaAsFET front end** on vhf models gives 12dB SINAD of 0.12uV (vhf), 0.15uV (220). UHF model 0.25uV std, 0.1uV with optional helical resonator preamp.
- **SELECTIVITY THAT CAN'T BE BEAT!** Both 8-pole xtal filter & ceramic filter for **> 100dB at only ±12kHz.** Helical resonator front end to combat desense & intermod.
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- **Courtesy beep,** field-programmable CWID, flutter-proof squelch, automatic frequency control to compensate for off-frequency transmitters (all standard features).
- **Full range of options** available, such as autopatch, phone line or radio remote control, sub-audible tones, duplexers.

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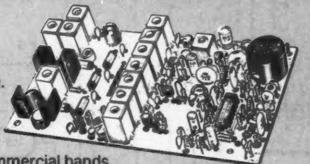
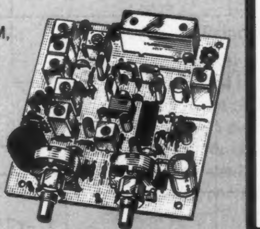


- **FM EXCITERS:** Kits $99, W/t $179. 2W continuous duty. TCXO & xtal oven options available.
- **TA51 for 10M, 6M, 2M, 150-174, 220 MHz.**
- **TA451 for uhf.** FCC type accepted for commercial bands.
- Call for latest information on 900 MHz transmitters.
- **VHF & UHF AMPLIFIERS.** For FM, SSB, ATV. Output from 10 to 50 Watts. Several models, kits starting at $79.



- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220 MHz. **GaAs FET** front end, 0.12uV sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: > 100dB at ±12kHz (best available anywhere)! Flutter-proof squelch. AFC tracks drifting transmitters. Kit $149, w/t $229.
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- **R76 ECONOMY VHF FM RCVR** for 10M, 6M, 2M, 220. Without hel res or afc. Kits only $129.
- **Weather satellite & AM Aircraft receivers also avail.**

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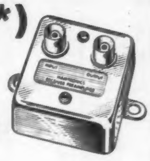
GaAs FET PREAMPS

at a fraction of the cost of comparable units!

LNG -(*) GaAs FET PREAMP



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FEATURES:

- **Very Low Noise:** 0.7dB VHF, 0.8dB UHF
- **High Gain:** 13-20dB, depending on frequency
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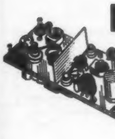
** Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW -(*) MINIATURE GaAs FET PREAMP



ONLY $24/kit, $39 Wired/tested

GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

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LNS-(*) IN-LINE PREAMP

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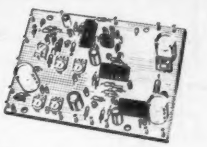

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Kit with Case	$59
Kit less Case	$39
Wired w/case	$89

Antenna Input Range	Receiver Output
28-32	144-148
50-52	28-30
50-54	144-148
136-138	28-30
144-146	28-30
145-147	28-30
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30

UHF MODELS

Kit with Case	$69
Kit less Case	$49
Wired w/case	$99

Antenna Input Range	Receiver Output
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25
902-926	422-448
902-922	430-450

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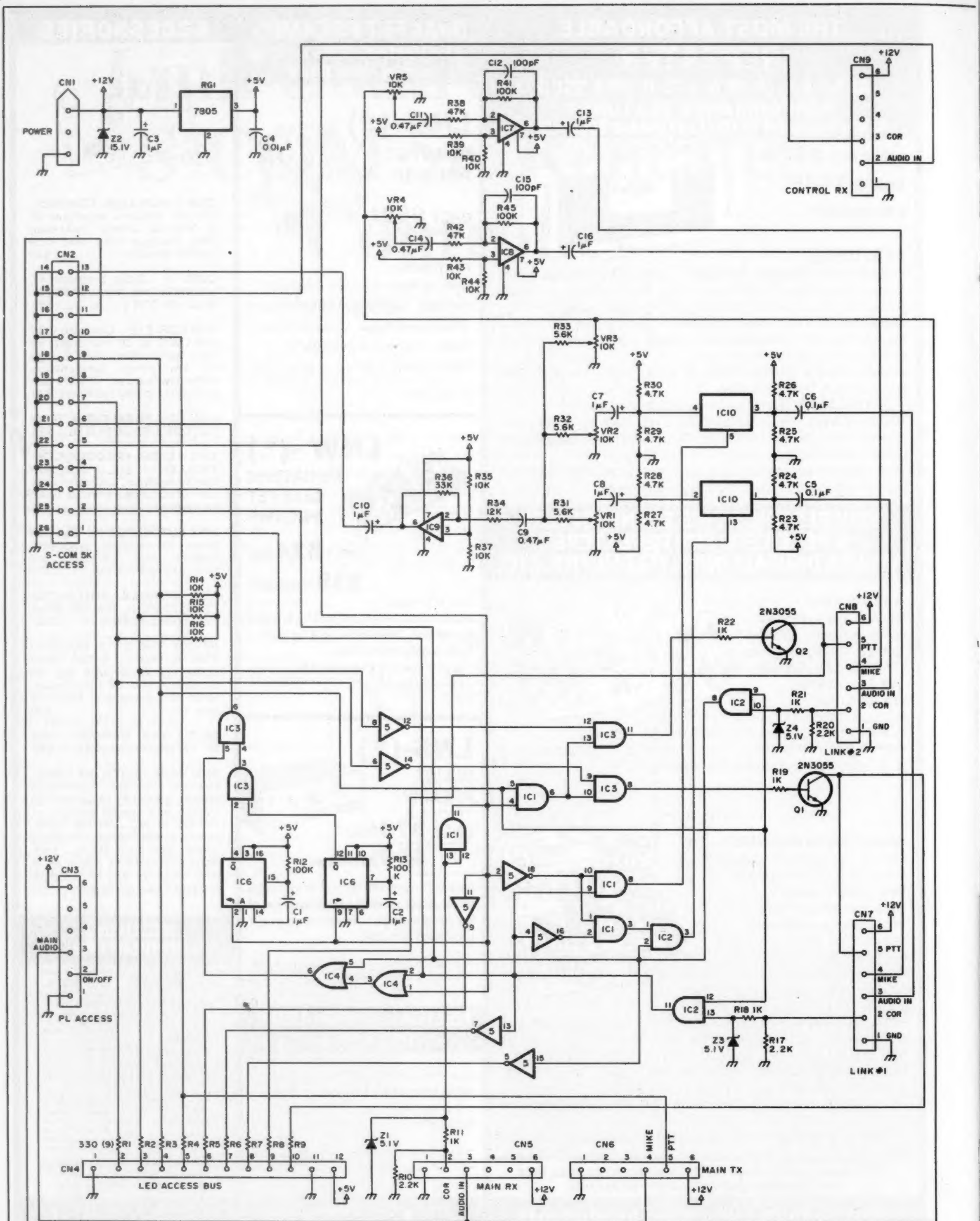
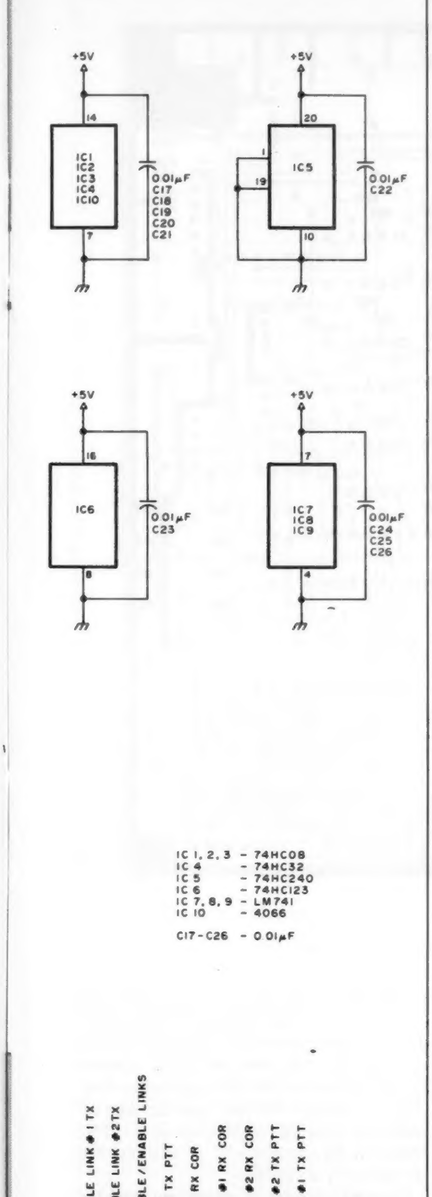

CN1
POWER
+12V
Z2 15.1V
C3 1µF
RG1
7805
+5V
C4 0.01µF
VR5 10K
C11 0.47µF
R38 47K
R39 10K
R40 10K
C12 100pF
R41 100K
IC7
C13 1µF
VR4 10K
C14 0.47µF
R42 47K
R43 10K
R44 10K
C15 100pF
R45 100K
IC8
C16 1µF
CN9
6 +12V
5
4
3 COR
2 AUDIO IN
1
CONTROL RX
CN2
S-COM 5K ACCESS
R33 5.6K
VR3 10K
R32 5.6K
VR2 10K
R31 5.6K
VR1 10K
C7 1µF
C8 1µF
R30 4.7K
R29 4.7K
R28 4.7K
R27 4.7K
IC10
R26 4.7K
R25 4.7K
R24 4.7K
R23 4.7K
C6 0.1µF
C5 0.1µF
R36 33K
R35 10K
R34 12K
R37 10K
C10 1µF
IC9
C9 0.47µF
R14 10K
R15 10K
R16 10K
IC3
IC6
R12 100K
R13 100K
C1 1µF
C2 1µF
IC1
IC2
IC4
5
R22 1K
2N3055
Q2
CN8
PTT
MIKE
AUDIO IN
COR
GND
R21 1K
Z4 5.1V
R20 2.2K
LINK #2
R19 1K
2N3055
Q1
CN7
R18 1K
Z3 5.1V
R17 2.2K
LINK #1
CN3
MAIN AUDIO
ON/OFF
PL ACCESS
330 (9)
R1
R2
R3
R4
R5
R6
R7
R8
R9
CN4
LED ACCESS BUS
Z1 5.1V
R11 1K
R10 2.2K
CN5
COR
AUDIO IN
MAIN RX
CN6
MIKE
PTT
MAIN TX

Figure 3. Schematic for the complete board of the 5K link controller.


+5V
14
IC1
IC2
IC3
IC4
IC10
7
0.01µF
C17
C18
C19
C20
C21
+5V
20
1
19
IC5
10
0.01µF
C22
+5V
16
IC6
8
0.01µF
C23
+5V
7
IC7
IC8
IC9
4
0.01µF
C24
C25
C26
IC 1, 2, 3 - 74HC08
IC 4 - 74HC32
IC 5 - 74HC240
IC 6 - 74HC123
IC 7, 8, 9 - LM741
IC 10 - 4066
C17-C26 - 0.01µF
ENABLE LINK #1 TX
ENABLE LINK #2 TX
DISABLE/ENABLE LINKS
MAIN TX PTT
MAIN RX COR
LINK #1 RX COR
LINK #2 RX COR
LINK #2 TX PTT
LINK #1 TX PTT
+5V
D1
D2
D3
D4
D5
D6
D7
D8
D9
0.01µF
CN10
LED ACCESS BUS

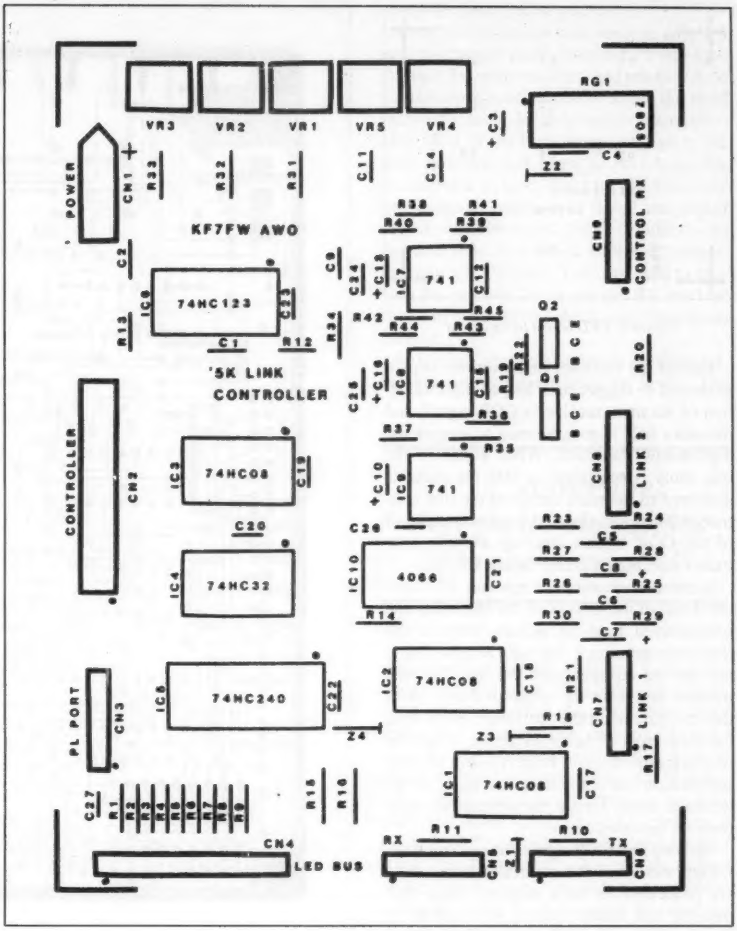

RG1
7805
VR3
VR2
VR1
VR5
VR4
C3
C4
Z2
POWER
CN1
R33
R32
R31
C11
C14
CONTROL RX
CN9
KF7FW AWO
R38
R41
R40
R39
C2
74HC123
IC6
C23
C9
C24
C13
IC7
741
C12
R13
C1
R12
R34
R42
R44
R43
R45
Q2
'5K LINK
CONTROLLER
C25
C16
IC8
741
C15
R19
R22
Q1
R20
CONTROLLER
CN2
74HC08
IC3
C19
R37
R36
R35
LINK 2
CN8
C10
IC9
741
C20
74HC32
IC4
C26
4066
IC10
C21
R23
R24
C5
R27
R28
C8
R26
R25
C6
R30
R29
C7
R14
PL PORT
CN3
74HC240
IC5
C22
Z4
IC2
74HC08
C18
R21
LINK 1
CN7
R18
Z3
R17
74HC08
IC1
C17
C27
R1
R2
R3
R4
R5
R6
R7
R8
R9
R15
R16
CN4
LED BUS
RX
R11
CN5
Z1
R10
TX
CN6

Figure 4. Main board parts layout.

Know Your Priorities

On any repeater system, the control receiver must carry the highest priority (see Figure 1). If this is not observed, the repeater may not be available due to access problems. The control receiver is not processed on the link controller; instead, it is simply passed directly to the main controller. The main receiver is the next priority. People access it to control the links, so either of the links carry less priority than the main receiver.

The two controllable links, of course, are next on the priority list. The links numbers, 1 and 2, pertain to the order of priority. If link 2 is active, and link 1 suddenly becomes active, then link 2's audio is cut off until link 1 becomes inactive. The same activity pertains to link 1 and the main receiver. The priority feature allows the repeater owner to assign the order of important to each item.

Constructing the COR Circuit

On any receiver, there is a voltage that changes when the receiver's squelch opens. This voltage, referred to as the COR (carrier operated relay) signal, tells the link controller when the repeater is active and when it is inactive. The controller's COR voltage needs to be greater than 3.0 volts for the controller to recognize it.

You can construct a simple, effective COR circuit from a single op amp and a variable resistor (see Figure 2). By adjusting the variable resistor to a point different from your receiver's carrier noise source (a voltage that changes when your receiver becomes active), the op-amp will change its output from low to high, indicating an active receiver is present. The link controller's COR input is at 2.2k ohm impedance. Once the signals are in the controller, they are buffered before any processing occurs. The main receiver's COR signal is passed directly to the links ORing section. At this point, all COR signals are passed to the main controller.

The greatest section that the main receiver's COR signal passes through is the time-out reset section. This section will reset the main controller's time-out timer every time the main receiver becomes active and every time it becomes inactive. IC 6, the 74HC123, is used for this purpose.

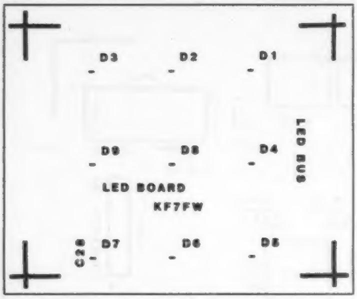


Figure 5. LED board parts layout.

Half of the one-shot multivibrator is programmed to trigger on a low-to-high transition of the main receiver's COR signal, and the other half is programmed to trigger the high-to-low transition. When either of the one shots is triggered, a 100 ms pulse is delivered to the reset circuit of the link controller. This reset circuit is needed because all of the COR signals entering the link controller are ORed together through IC 4.

In correct operation the repeater will time-out if one of the links is on for more than the programmed time-out period. Without the time-out reset circuit, the main receiver could not use the repeater until the links became inactive and reset the time-out timer. With the reset circuit on the controller, every time the main receiver becomes active, it sets the time-out timer to zero. If the repeater is timed out because one of the links was on too long, it is back, ready for use, the moment the main receiver becomes active.

The two link COR signals do not reach the ORing section of the controller before they are processed for their priority. Once they pass the link enable section, IC 2 and IC 3, they now head for IC 4, the COR ORing section. Now their priority is to switch one of the link's audio source to the main controller's audio section. Audio switching is accomplished by IC 10, a 4066 which contains four analog switches. This switch makes or breaks the audio from both links. Link priority only applies to audio; it decides which audio is routed to the main controller. Once audio switching occurs, you can adjust the audio level before it enters the mixing stage of the link controller.

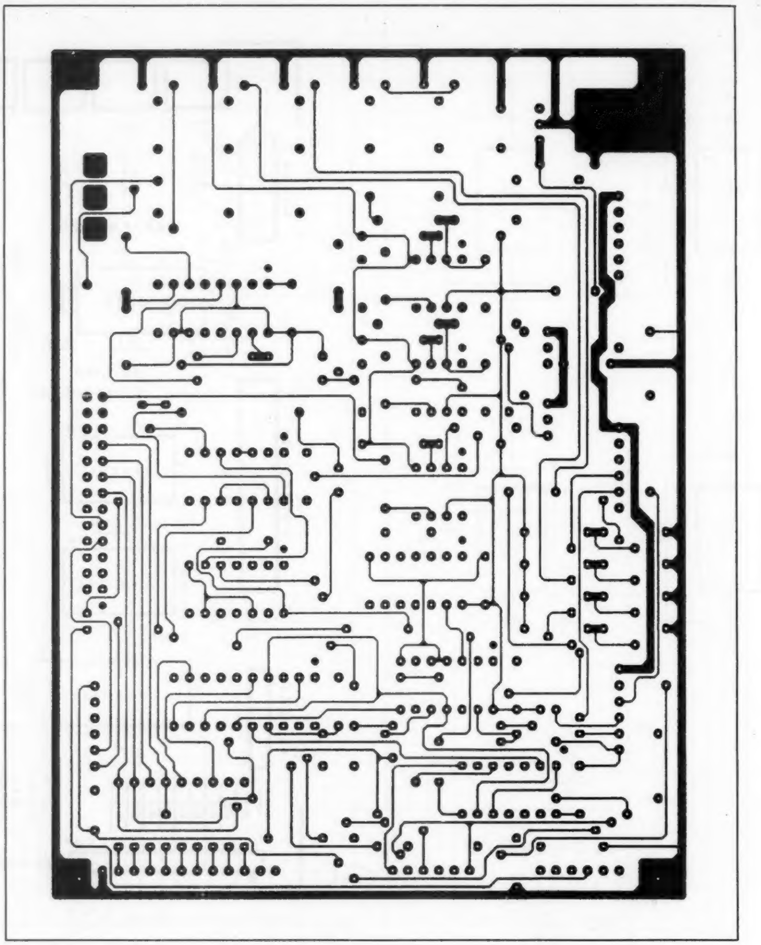


Figure 6a. Top foil layout for the main board..

Time to Transmit

The purpose of a repeater link is to transmit. If your links were always enabled, your repeater would be tying up another repeater, as well as your repeater, on every transmission. The main controller controls the section of the link controller that enables the links to transmit. Three MOSFET switchable lines come from the S-COM 5K controller and are processed by the link controller before they can PTT either of the link transmitters.

The first two lines, Out 1 and Out 2, are inverted by IC 5 and then gated through IC 3. The third line, Out 3, determines if the main receiver's COR signal will reach the link transmit enable section. If Out 3 is enabling the links, and the user has enabled one of the link PTT lines, then the enabled link transmitter will follow the main receiver's COR signal. (Refer to your S-COM manual for the output enable commands.)

The link transmitter's 2N3055, a hefty NPN current driver transistor, drives the PTT circuit of the link's radio. The link controller will supply a ground to your transmitter PTT. It was not designed to handle the current of the link transmitter. If you need a high current PTT driver, use an external relay that will handle the current. A +12 volt line is supplied on the link controller's edge connector. Use this line for any low current +12 needs, i.e., a +12 volt PTT relay. If problems occur on either of the incoming links, you can simply use the Out 3 line to disable the links, shutting down the link section of the controller completely. If you do this, only the main receiver's COR signal is active on the link controller.

Controlling the Links

The link-enable line controls the two links. Using this line, you can shut off the links if, for example, the repeater that you are linked to malfunctions and stays keyed up. First, the controller would time-out after extended use, then you would enter the correct code to shut the links off. This way, the faulty repeater link won't time-out the main repeater system. After the problem is fixed, you can then re-enable the links and continue operations. This feature is especially useful at locations that are not easily accessible.

Once the links are working, how does the user identify which link is which? The S-COM 5K controller has 3 input lines to the main controller. These lines can be programmed to react to changes in their logical states. Link 1's COR signal is connected to Input 1 on the main controller, and link 2's COR signal is connected to Input 2. The main receiver's COR signal is connected to Input 3.

Using the S-COM 5K's macro feature, you can program the controller to change the courtesy tone to a different tone when the links become active. This is the easiest way to signal the user of an incoming link message. There are many possible ways to program these lines.

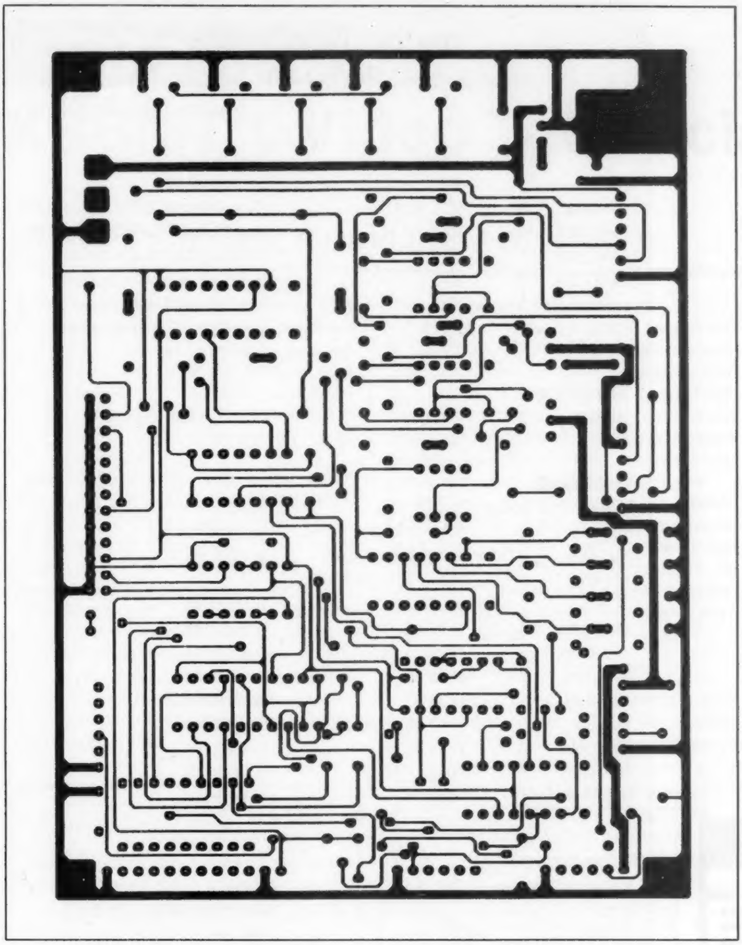


Figure 6b. Bottom foil layout for the main board.

Link Controller's Appearance

The cosmetics of the link controller are not complete without the lights. A 12-pin connector on the link controller's board lets you have external LEDs so that you can see what is happening on the link board.

Part of IC 5, the 74HC240 driver chip, sinks (supplies a low level) to the LEDs when the display is active. All of the current-limiting resistors for the LEDs are mounted on the link controller's board. Just add the LEDs.

If low power applications are required, special 1 mA LEDs are available with only minor changes to the link controller board. By changing the current-limiting resistors from 330 ohm to 4.7k ohm, and using special low power LEDs, you save 126 mA from the LED display board. The display section will show the main receiver's COR, both links' CORs, the main controller's PTT along with the two links' PTT, the two links' PTT enable, and the link enable's signal. This display feature will come in handy when programming the main controller or tracking problems in the repeater system. Just look at the display and presto, your questions are answered.

A Little Caution, Please

When constructing and handling the link controller board and components, remember that static electricity kills components. Use CMOS handling precautions. Always make sure that any static electricity is discharged from your body before touching any component or the main controller board.

Adjusting the Link Controller

Adjustment is simple and fast. To start out, adjust the three receiver level pots, VR 1, 2, and 3 to a 12 o'clock position. For proper adjustments, you'll need an auxiliary receiver that monitors the repeater's transmitter. Once the monitoring receiver is adjusted to an acceptable level, transmit a known level, such as a touch-tone from your hand-held, for a known level reference. Now open the squelch on the main repeater receiver, and transmit on the main repeater transmitter. Adjust VR 3, the level pot, of the main receiver on the link controller board, for a good level.

Once you have your main receiver adjusted *near* the correct point, transmit a touch-tone through the main receiver, and monitor it on the reference receiver. Now adjust the main receiver's audio level to match your reference level. If the level is too low, go to the main controller and locate the pot labeled RX and increase its level. Once the main receiver sounds good, move on to link 1 and adjust only its input level pot, VR 2. Continue with the same procedure as link 1 for link 2 adjusting only VR 1's level. You may need to play with the receiver levels and the RX level on the main controller to obtain a suitable audio balance.

Once the three receiver levels are adjusted, move on to the three transmitter levels. The main transmitter level, marked TX, is on the main controller board. This is the only adjustment used to control the main transmitter audio level. When you obtain a suitable mike level for the main transmitter, you need to adjust the two link transmitters. On both the links, audio levels are located on the link controller board. Link 1's output level pot is marked VR 5, and link 2's level pot is marked VR 4. To adjust their levels, input the appropriate code to enable the link portion of the controller, Out 3. Now input the code to enable the link transmitters, Out 1 and Out 2.

". . . remember that static electricity kills components."

To keep from overdriving your link transmitters' mike input, bypass the first mike amplifier section, and apply the links' audio at this point; you'll get cleaner audio on your link transmitter. If access to your mike amplifier is difficult, adding in a series resistor with the value between 50k and 100k ohms will keep the link controller from overdriving your link transmitter. Use your reference receiver to calibrate both of your link transmitters' levels, and use the same procedure when you adjust your link transmitter levels that you did when you adjusted your main receiver level.

Now input the same touch-tone on the main receiver's frequency. You enable the links so the main receiver will control the link's transmitters. Now adjust VR 4 and VR 5, the output level control on the link controller, so it matches the earlier observed level on the link monitoring receiver. Once link 1 is adjusted, proceed to link 2. Do the same adjustments for link 2 as you did for link 1. Once you have adjusted the levels, you should no longer need to do any adjusting on the link controller board.

Conclusion

The complete link controller and S-COM

5K system are currently in use on my 444.500 MHz and 147.380 MHz repeaters. With difficult access to the 147.380 MHz repeater site, I put plenty of care into the design and building of this link controller. I haven't had any problems with either the S-COM 5K or the link controller since transplanting them on the mountain. This controller was designed around the S-COM 5K repeater controller, but you can adapt it to any controller that has 3 logical outputs and 3 logical inputs. The combined link system and main controller, once built, totaled about $240. For a 2-link prioritized microprocessor-based repeater system, the price cannot be beat.

Both of the circuit boards are available from me. My address is 306 S. 20th St., Bozeman, MT 59715. The '5K Link Controller Main Board is $28.50 plus $2.50 S/H. The '5K Link Controller LED board is $7.50 plus $1.50 S/H. Both boards are $34.50 plus $2.50 S/H. The main board includes plate through-holes, solder mask, and parts ID mask. The LED Board is a non-plated through-board, but it comes with the appropriate ID mask.

The S-COM 5K Repeater Controller is available from S-COM Industries, PO Box 8921, Ft. Collins CO 80525-0700 (303-493-8316) for $189.

Happy home-brewing! ■

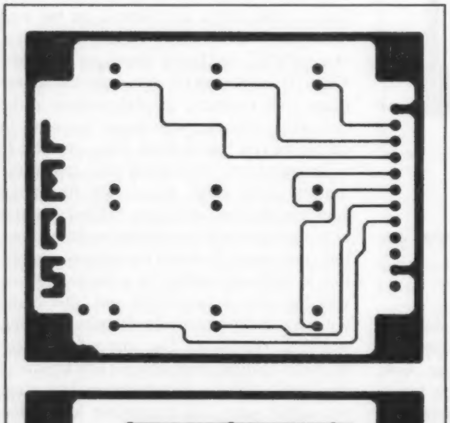


Figure 7. a) Top foil layout for the LED board. b) Bottom foil layout for the LED board.

The '5K Link Controller Parts List

ICs

	Quantity	Chip #	Description
7805	1	RG1	5 volt regulator
74HC08	3	IC 1, 2, 3	Quad 2 input CMOS logical AND
74HC32	1	IC 4	Quad 2 input CMOS logical OR
74HC240	1	IC 5	Inverting CMOS line driver
74HC123	1	IC 6	Dual CMOS multi-vibrators
LM741	3	IC 7, 8, 9	8-pin dip-packaged op amp
4066	1	IC 10	Quad CMOS analog switch

Transistors

2N3055	2	Q1, Q2	TO-220 NPN transistor

Resistors

Value	Quantity	Res. #	Style
10k ohm	5	VR 1,2,3,4,5	Variable res.
330 ohm	9	R 1,2,3,4,5,6,7,8,9	¼ Watt res.
10k ohm	9	R 14,15,16,35,37,39, 40,43,44	¼ Watt res.
100k ohm	4	R 12,13,41,45	¼ Watt res.
4.7k ohm	8	R 23,24,25,26	¼ Watt res.
47k ohm	2	R 38,39	¼ Watt res.
12k ohm	1	R 34	¼ Watt res.
1k ohm	5	R 11,18,19,21,22	¼ Watt res.
5.6k ohm	3	R 31,32,33	¼ Watt res.
2.2k ohm	3	R 10,17,20	¼ Watt res.
33k ohm	1	R 36	¼ Watt res.

Capacitors

Value	Quantity	Cap. #	Style
1 mF	8	C 1,2,3,7,8,10,13,16	electrolytic. cap.
0.1 mF	2	C 5, 6	disk cap.
0.47 mF	3	C 9, 11, 14	disk cap.
100 pF	2	C 12, 15	disk cap.
0.01 mF	11	C 4, 17–28	disk cap.

LEDs

Type	Quantity	Diode #	Style
Red	3	D 4, 8, 9	Red - transmit
Yellow	3	D 5, 6, 7	Yellow - COR
Green	3	D 1, 2, 3	Green - Enable/Disable
5.1 V	3	Z 1, 3, 4	1N4733 5.1 V Zener Diode
15 V	1	Z 2	MPTE15 15 volt Zener Diode

Connectors

Type	Quantity	Conn. #	Style
wafer	6	CN 3,5,6,7,8,9	6-pin Modular connector
mate	6	CN 3,5,6,7,8,9	6-pin Modular connector
wafer	1	CN 4	12-pin Modular connector
mate	1	CN 4	12-pin Modular connector
male	1	CN 2	26-pin Ansley right angle
female	1	CN 2	26-pin Ansley cable crimp
male	1	5K connect	DB-25 male cable crimp
male	1	CN 1	3-pin Molex PC mount
female	1	CN 1	3-pin Molex crimp mount
cable	1 ft.	26-pin ribbon cable	

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73 Review

by Linda Reneau

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Jerry Ziliak KB6MT is a ham in more ways than one. On the TV screen, he stands out as an enthusiastic and personable instructor. On the audio tape, his enunciation and voice tone are perfect for easy listening and learning. His Video Technician Course consists of two 2-hour VHS video cassettes and a C-60 audio cassette tape.

After listening to the audio cassette tape twice, I gave myself a sample Technician exam and scored in the nineties. While I admit I've learned a lot from editing articles for *73* this past year, I had not yet learned the FCC rules and regulations, or proper theory.

The pace is fast. This tape was obviously made to be listened to. Instead of taking notes, you simply let the information sink naturally into your personal database (the one you will have to access when you take your exam) as you go about your business, drive your car, or sit back and relax.

Conventions and Natural Forces

On the audio cassette, KB6MT begins with a discussion of FCC rules and regulations, emergency communication procedures, third party operation, and international communications. He includes definitions of what is and what is not considered broadcasting, cautions you to watch your bandwidth and power out, and adds some pointers on ham etiquette.

After basic operating procedures, KB6MT discusses propagation, measuring devices, equipment, antennas, electrical theory and components, and frequency modulation. He gives clear definitions and usually adequate explanations. He covers Technician privileges, mobile operation, and formulas.

No Time to Spare

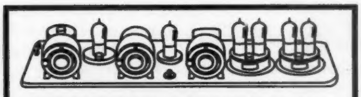
On the video tapes, KB6MT seems to work from an outline when he could use a script. With his hastily drawn diagrams and run-on sentences I felt like Alice trying to keep up with the rabbit. A pause, however brief, at the end of a sentence, aids mental digestion. Pauses are also useful for highlighting, framing, and emphasizing important material. What would code be without pauses? Note that the *speed* of Jerry's delivery is fine.

The Verdict

The video tapes need some improvement. I suggest the following: a script, a steady pace with adequate pauses, carefully drawn diagrams, more theory, no verbal mannerisms, and a more relaxed (even if speedy) delivery.

Last, a test or booklet with questions and answers would provide the student with feedback, an essential element for fast learning. Without taking an exam, how could I have tested my knowledge?

In spite of its drawbacks, I learned a great deal from KB6MT's Video Technician Course.



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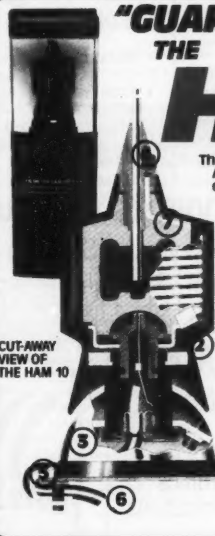

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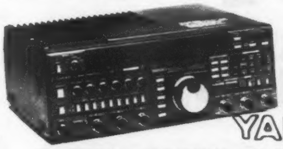

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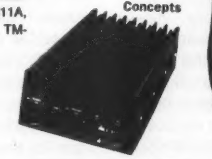
RF Concepts



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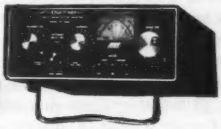

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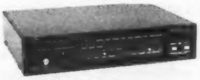

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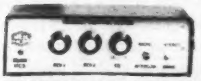

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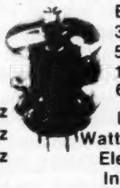

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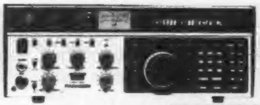

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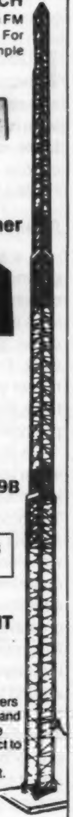

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73 Review

by Marc Stern N1BLH

The MFJ-931 RF Tamer-Ground

Getting it down to earth.

The MFJ-931.

MFJ Enterprises, Inc.
Box 494
Mississippi State, MS 39762
(601)323-5869
(800)647-1800
Price Class: $75

If you are one of the thousands of "cliff-dwelling" operators, you know how tough it is to establish a real RF ground, and how easy it is to establish a reasonable DC ground. Make no mistake about it, apartments or condos are more difficult to operate from; and RF and DC grounds are entirely different.

RF and DC Grounding

In a sense, a DC ground is also an earth ground; it is a safety path to earth. It conducts current away from equipment and keeps you safe. In a larger sense, it is one side of the circuit path that enables your equipment to work. Finding a good DC ground is usually a matter of simply attaching a ground wire to the third, or ground, wire in an electrical outlet. It's pretty straightforward.

On the other hand, finding an RF ground when your operating position is several wavelengths above the earth is next to impossible. The problem is your height above the ground. As your operating position moves more than a wavelength above the earth at your favorite operating frequency—quite likely if you live in a multi-story apartment complex—then it progressively gains a tendency to "float" above RF ground. This can create all kinds of havoc, including RF current loops and hotspots around the shack. The RF is looking for a path to a true earth ground, and is finding nothing. Therefore, it begins looking for what it considers to be the next best thing, which is just about any metallic object attached to your operating position. The result, as more than one operator has found, is burned fingers from RF on equipment. If the world were ideal, this would not happen, and RF would behave itself and take the path of least resistance out of your shack, into the ground, and into your antenna system. But the world isn't ideal and this problem has caused a great deal of grief for many cliff-dwellers.

Not knowing the peculiarities of grounding, many apartment-bound operators have made the collective mistake of assuming that, if they simply established a good connection to the cold water pipe, the RF problems would go away. This assumption may be based on the belief that cold water systems are all-metallic. However, given today's plumbing, it is more than likely that there will be a section of PVC piping somewhere in the system. This can effectively insulate the cold water system from the ground.

Higher Isn't Always Better

Let's assume that the operator's apartment or condo is several stories above the ground. Given this situation, it is more than likely the cold water piping will become part of the antenna system and will resonate at various frequencies, not necessarily the ones the operator wants. This might lead to RFI complaints and could cause the operator to QRT—not a great situation.

The classic way of solving this problem is to create an "artificial" RF ground of counterpoises, and to lay them around the shack or to run them along the baseboards. However, while this can effectively cancel the RF hotspots on the equipment and in your shack, it can also lead to other problems, most notably problems with children or animals coming into contact with hot counterpoise wire, or with apartment mates yelling about how messy things are with all the wires running about.

By now, you have probably assumed that there's only one solution—QRT—but that doesn't have to be the case at all. The solution comes from one of America's last suppliers of ham goodies: MFJ Enterprises, whose artificial ground solves this problem.

Compact Artificial Ground

The MFJ-931 Artificial Ground is really a "tuner" for your ground or counterpoise system. It may seem a little out of place to think about tuning your ground or counterpoise system for best performance, but it really does make sense. Just as you can tune your antenna system for maximum performance, you can also tune your ground system for best performance. Antenna systems and ground systems are analogous in many ways.

If you are a ham homeowner, you probably enjoy the luxury of a true earth ground right outside your shack window. Or, if it isn't exactly right outside the window, it's within a reasonable distance. The result is that all the stray RF currents that might be created by imbalances within your antenna system or your station are usually shunted right to ground and you never notice a thing. Now, translate that to the typical cliff-dwelling operator, whose ground may be a cold water pipe several stories above the ground. As has been noted, all the cliff-dweller is assured of is a good DC ground because this setup is almost guaranteed to produce a poor RF ground.

With the MFJ-931, you can tame this situation drastically: you can tune your ground system for best performance and maximum RFI suppression. By best performance, I mean that minimum RF current is roaming around the shack and maximum signal is going to the antenna system. For example, I've tried the MFJ-931 with a more-than-slightly-weird loop wrapped around a third-floor window. It has also been tried with an old Army surplus window-sill-mounted 72" whip, as well as a variety of resonant antennas. All of these antennas have been used for tests, three stories above the ground, with a ground system attached to the cold water system of the building.

Cooling the Hotspots

The results, after a couple of months of testing, are good. For example, when I used the MFJ-931 with the braid that I clamped to the cold water system, I found that various knobs and metal cabinets that had been slightly hot with RF had cooled down. The MFJ-931 had taken the RF hotspot on my equipment and moved it down the braid used for grounding. The RF had been moved to the copper piping of the cold water system. The MFJ-931 didn't create a true ground, but it did move the problem closer to the earth, where it belonged.

The ground wire became hot when RF currents were flowing. Realizing this, I used insulated wire wherever runs were exposed to the paths prowled by the cat that inhabits my shack. I would suggest insulating the wire and routing the ground cable away from the paths of any small children or pets that you have running around. If you do not, you chance having a tiny member of your family get a nasty burn.

As you can see, the MFJ-931 is no substitute for a good earth ground. However, when you are a cliff-dweller, you have few other choices. True, the MFJ-931 doesn't make an antenna or antenna system perform any better—it can't. It does, however, greatly help cure RFI.

RFI Suppression

The MFJ-931 can be used two ways: directly with the ground system, or as a counterpoise tuner. Most operators will probably use the MFJ-931 in the first configuration.

I used the MFJ-931 in the "normal" configuration for the first part of the evaluation. In this configuration, the MFJ-931 moved the unwanted RF down the ground braid to the cold water piping. In truth, though, while this was a nice configuration for operating, it wasn't maximizing the MFJ-931's RFI suppression capabilities. RFI suppression was maximized when I used the MFJ-931 with tuned quarter-wave counterpoises. Incidentally, when I used it with the tuned radials, the unwanted RF on the equipment was also drastically reduced. Tuning the radials not only improved the performance of the antenna system, it also tuned out unwanted RFI.

Inside The MFJ-931

Look at the MFJ-931 closely and you'll see how uncomplicated it really is. The major parts consist of a 12-position tapped coil, two transmitting-grade air-variable capacitors, a toroid, and an RF sampling ammeter. Most of the major components are isolated from the chassis, with one exception that I'll get to in a minute.

All of this makes you wonder why someone hasn't thought of a device like this before, and it makes you realize just how ingenious a device the MFJ-931 really is. In the 931, MFJ has created a relatively simple device that works well, and which cures a couple of problems that have haunted amateurs for years.

Installed at your tuner, the MFJ-931 picks up the earth ground cable on one side and the normal tuner ground on the other. Alternatively, you can leave the earth ground cable where it is and install the MFJ-931 between your tuner's ground and a counterpoise system.

Once you've installed the MFJ-931, it's easy to operate. You simply rotate the inductor selector and watch the needle on the RF ammeter. When you see a peak in the ammeter reading, you know you've hit the right spot for resonance. After the inductor is tuned, rotate the capacitors to fine-tune the peak. Usually, you will find that this point not only indicates maximum current transfer to the radial or ground system, but it also shows the resonance for the antenna system as a whole.

As I noted, the MFJ-931 is well-built. Not only does it use quality components that can easily handle anything you throw at it (provided, of course, you don't try hitting it directly with 3 kW of RF), but it should also last for years. It is housed in an RF-tight aluminum cabinet. All the parts are well isolated.

A Drawback

I did spot one minor inconvenience as I used the MFJ-931: There is a certain amount of hand capacitance that can affect the settings. MFJ mounts the capacitor used to null capacitance on the front panel of the MFJ-931. It is isolated from the chassis by nonconductive fiber washers. This placement effectively raises the capacitance control above chassis ground and allows it to float in relation to the MFJ-931. The result is that once you have made your adjustments, you may see them change as you move your hand away from the controls. A good suggestion might be to move the control into the cabinet and mount it on the insulators. This should effectively eliminate the problem.

Docs

The brief documentation included with the MFJ-931 not only covers the installation procedures, but also makes suggestions about where to place the MFJ-931 and how to configure your operating system. It provides a readable overview of the problem that the MFJ-931 helps to solve. About the only thing it doesn't do is present you with a detailed schematic of the MFJ-931. I suspect that most operators probably won't miss the lack of the schematic, but I did.

Overall, I'm glad I found the MFJ-931. It certainly cleans up hotspots and helps to make things far more pleasurable at the operating position. If you're in this situation, or if you need something for a DXpedition or vacation hideaway where there is no good earth ground, take the MFJ-931 along. You'll find it a good addition to your equipment. ■

JANUARY 4, 1983
* *
A CURE WAS FOUND
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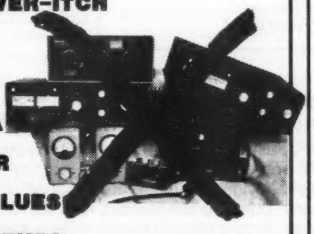

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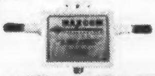

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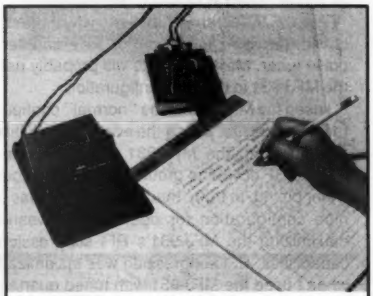
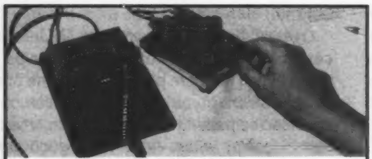


TRAINER

Code generator	• Random code generator 5 characters/code group
Speed	• 5 WPM to 30 WPM 1 WPM increment



ELECTRONIC KEYER

Paddle input	• TTL level —LO/Actuating, HI/Stop Contact input —ON/Actuating, OFF/Stop
Key input	• TTL level —LO/Mark, HI/Space Contact input —ON/Mark, OFF/Space
Keying speed	• 5 WPM to 30 WPM 1 WPM increment
Keyer output	• Transistor switching, Open collector type

SPECIFICATIONS

Model	• AR-501 Radio telegraph terminal
Power source	• DC 12V to 13.8V—165mA
Size	• 4.5"-W x 2.24"-H x 6.25"-D
Weight	• 12.5 oz. (358 g)
Controls	• Power On/Off • Random code generator On/Off • Print-out On/Off • Monitor speaker level • Electronic keyer mode select • Speed Up & Down
Display	• LCD 32 characters—16 per line
Indicators	• Power On—Green LED • Tuning—Red LED
Front connections	• Paddle—Standard/Iambic • Ordinary telegraphic key • Headphone/Earphone
Rear connections	• DC 13.8V input • Audio input • External speaker • Keyer output • Printer output

PRINTER PORT

- Compatible with Centronics 8-bit parallel printer. At least 4K byte data buffer is required in a printer.

BACK TO BASICS — • — • But far more advanced — — • —

The AR-501, triple mode CW terminal in a small package, is a powerful gear to practice and play with. For the Novice, SWL and Amateur radio operators it detects Morse code between 5 to 30WPM. Just plug the AR-501 to your receiver to start translating the Morse code onto full 32 character LCD display. Very simple and easy to operate. You ask; for code practice?, both receive and transmit? Yes, the AR-501 does just that. It will improve your cord reception and keying technique at the speed you want. More?. it operates as an electronic keyer both standard and iambic. More Yet? How about a printer port? You bet, the AR-501 provides parallel printer port for hard copy. You can Log the QSO, and Practice. It will help you immeasureably. We even offer a standalone Nicad operated thermal printer as an option. **ACCESSORIES SUPPLIED:** The AR-501 Radio telegraph terminal comes complete with Receiver cable, DC Power cable, Miniature Phone plug, Miniature stereo phone plug, Spare fuse, Wall receptacle style power adaptor and Instruction manual. **ACCESSORIES AVAILABLE:** CC-501 Parallel printer cable — **$30.00**/DPU-411 Standalone Thermal printer with 8K buffer.—**$235.00**

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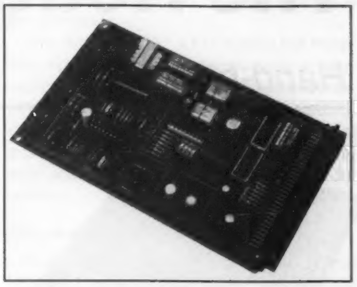
73 Review

by Peter J. Bertini K1ZJH

Maggiore HPC-201 Repeater Controller

Maggiore Electronic Lab.
600 Westtown Road
West Chester, PA 19382
(215) 436-6051
Price class: $495



The HPC-201 repeater controller.

The Maggiore HPC-201 Deluxe controller and full-featured autopatch is moderately priced and powerful enough to seriously compete with controllers costing twice as much. Our club has five repeaters equipped with the HPC-201 controllers. The autopatch features alone justify the price. I will cover the controller first, and then discuss the autopatch.

Hardware

You can buy the controller with any of the Maggiore repeaters, or buy it separately. Two of our controllers are in Maggiore Hi-Pro Basic repeaters. Three other club machines, a Spectrum SCR-1000, a Spectrum SCR-77, and a GE Master Pro are using HPC-201 controllers. The controller card is only 3⅞" by 6¼" and the construction is first-rate. The controller requires 10–15 volts DC at 190 mA, and has provisions for battery backup. An LM324 assists with the repeater and autopatch audio chores and an LM555 audio oscillator voices the CW messages, courtesy, and warning tones. This oscillator also produces the reverse patch ring-out tones, and patch and repeater time-out warnings. The HD63P01 microprocessor with its piggybacked ROM is the heart of the controller. Other chips interface the microprocessor to the real world. Seven 500-mA open-collector outputs are available for controlling external devices. You can use two auxiliary inputs for burglar and battery alarms, or phone line sensing. Complete documentation is supplied. The two COR and audio inputs are nice features which allow a link or control receiver to operate with the controller.

The Controller Command Set and Security

The controller currently supports over 80 commands. It would be impossible to cover all of them in this review, but I'll highlight the important ones. You can set just about every repeater parameter remotely,either through the phone line or on-the-air, using touch-tone entry. A five-digit security code precedes the command entry to insure security. The command codes are two digits (decimal values), and sometimes an operant follows the command to enter new hex values for timers, ID speeds, pulse-dial rates, etc. You may change the security codes at any time. If for some reason the security codes are lost or inadvertently changed, the trustee may use a second five-digit security code to reset the controller to its power-up parameters. The repeater responds with a CW "OK" to verify that it has accepted the command.

Firing It Up

On power-up, or when a master-reset command is given, the controller resets to specific default parameters. Most of these parameters can be preset when the EPROM is programmed at the factory. Defaults include all of the control and access codes for the repeater and autopatch. You can change the ID callsign at any time.

A special user access code allows members limited access to some of the repeater command codes, including three of the auxiliary outputs. This allows the regular users access to links, prerecorded messages, etc., without making them privy to all of the control commands and security codes.

The Full-Featured Autopatch

The autopatch may be open or closed access. Closed access requires a three-digit code to access or disconnect the patch. The repeater acknowledges successful patch termination with a multi-tone signal. It issues a warning warble ten seconds before a patch time-out. The autopatch timer may be set for either a five or ten minute limit, or unlimited patch time. You can set the patch to allow toll calls or seven-digit dialing. Also, you may specify the minimum and maximum numbers that can be entered for dialing. For instance, setting the minimum/maximum for a value of seven and eight allows local calls and limited long-distance dialing. The patch can also ignore either (or both) a '0' or '1' first digit entry. Dial-a-porn 1-976 exchanges may also be inhibited.

On a PBX requiring a number nine to reach an outside line, the patch can dial the number automatically for the users. The HPC-201 also has a last number redial feature. When the controller shares the line with a home or business phone, or even another controller, a simple add-on circuit senses the line and disables the patch while the line is in use. The sensing circuit will also terminate the patch when the party called hangs up. The autopatch has two modes of reverse patch. Reverse patches may be disabled.

The Auto-Dialer

Up to 800 numbers can be stored in two auto-dialer memory banks. These numbers are stored in the same EPROM containing the operating program. Either bank can be turned off or on. The auto-dialer functions independently of the main patch. One bank is for user phone numbers and the second bank is for emergency numbers, although either bank may be used for any purpose. Long distance numbers may be stored and dialed by the auto-dialer regardless of whether the main autopatch parameters prohibit such calls. Special numbers, such as '0' for operator or 911 for emergencies, may be in the auto-dialer. The time limit set for regular autopatches governs auto-dialed calls.

Other Features

The repeater will issue a warble-tone warning several seconds before, and just as, a time-out occurs. The autopatch dialing speed is variable; some electronic telephone exchanges will allow dialing up to 20-pps, which allows the operation to really speed up.

The Identifier

You can set this in either five or ten minute intervals. The identifier normally identifies on the repeater squelch tail, but it will ID over a long-winded user if the ID is past due. A special "alert" message may be appended to the beginning and end of the CW ID to warn users of impending severe weather.

Programming the EPROM

The first 25 autodialer numbers are programmed gratis. There is a small service charge for additional numbers. Some familiarity with hex numbering will allow anyone with access to an inexpensive EPROM programmer to change or enter their own phone numbers. Directions for phone number programming is provided.

A well-documented source listing is available. With this, you can begin changing defaults and call letters. There is no need for an assembler to do these tasks. The software is written in MC68701 assembly language. Every time I think they have done all that can be done with the HPC-201, a new software revision comes out with a feature we like. You can trade in your old EPROM for the latest version for a modest charge.

All in all, the HPC-201 repeater controller is a good bargain for the money, and we heartily recommend it. Write to me (20 Patsun Rd., Somers, CT 06071) or contact Maggiore for more information on its features.

73 Review

by Tom Gilchrist N7KHU

The Heath HK-21 TNC

Hand-held TNC!

Heathkit
Heath Company
Benton Harbor MI 49022
To Order: (800) 253–0570
Store Location Information: (616) 982–3614
Price Class: $220; battery pack, $18

Heath
POCKET PACKET
Heath HK-21
CON DCD STA PTT PWR
RADIO
SP/IN
MIC/PTT
232C LED
POWER

When I saw the ad for the Heathkit HK-21 TNC, I knew I just had to have one. Heath calls the HK-21 a "Pocket Packet" for a very good reason. It's a compact, self-contained TNC with a built-in personal packet bulletin board system (PBBS). It was just the excuse I needed to put together a portable packet radio system.

The system I finally built fits into a molded equipment/camera case, just the right size to take on vacations, business trips, or whenever I want to operate packet away from my base station.

Hardware Features

Heathkit sells the HK-21 already assembled. It's just as well, since, after looking inside, I'm not sure my hands would be steady enough to put this one together. Photos A and B show the main board, with ICs mounted on both sides.

The system is built around a Z-80A, software compatible ASIC (Application Specific Integrated Circuit). This 100-pin pack is soldered on the back of the main board (Photo B) and contains enough smarts to keep the total chip count of the TNC to only 9 packs. The other card is only half as long as the processor card and contains the modem and 5 volt DC power supply.

One of the first reasons to consider the HK-21 is its size. It measures 2½" wide x 1" high x 4¼" long with no cables plugged in. Add another two or three inches to cover the RS-232 DB-25 male plug on the back and the radio connection cable on the front.

With the internal battery pack, the unit weighs about 5½ ounces. The TNC is smaller and lighter than almost any 2 meter hand-held (HT). I added a strip of hook-and-loop fastener to the bottom of the HK-21 and to the back of my HT, and mounted the TNC to my HT (see Photo C).

While the compact size and weight are two of the most obvious visual features, the HK-21 has a number of internal features worth mentioning.

An Inside Look

First, the unit draws very little current. In standard 12 volt DC use, it draws a little less than 40 mA. This makes the unit just right for battery and solar applications. It works with external voltages from 10 volts DC to 13.8 volts DC.

The optional internal NiCd battery pack is rated at 120 mAh and is charged whenever external power is applied. In my system, the internal battery lasts for three to four hours of continuous use. This is more than enough time to go through two battery packs on my HT and just about the time it takes to deplete the NiCds in my Model 102.

Figure 1 shows the details of the front panel. There are two DIP switches on the panel which will turn off the power to the status LEDs and the RS-232 port. Turn off the LED switch to save battery juice. The RS-232 switch turns off the MAX-232 chip in the unit which converts the TTL serial level of the TNC processor chip to the +/− 12 volt DC RS-232 levels. Using the internal HK-21 PBBS software, you can turn off the MAX-232 when you are using the HK-21 as a dedicated digipeater or PBBS. I did a test that showed that turning off the LEDs adds up to 30 to 45 minutes to the life of the internal battery.

In my portable unit, I usually use an external 12 volt 2.5 VA Gel-Cell to power both the HT and the HK-21, so saving a few mA is no big deal. Also, I am used to watching the LED status indicators. Because the HK-21 uses differently colored LEDs for each status indicator, you can read the TNC status at a glance.

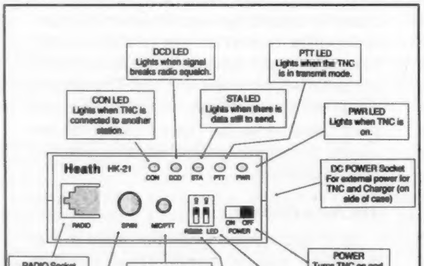

DCD LED
Lights when signal breaks radio squelch.
PTT LED
Lights when the TNC is in transmit mode.
CON LED
Lights when TNC is connected to another station.
STA LED
Lights when there is data still to send.
PWR LED
Lights when TNC is on.
Heath HK-21
CON DCD STA PTT PWR
DC POWER Socket
For external power for TNC and Charger (on side of case)
RADIO
SP/IN
MIC/PTT
RS232 LED
ON OFF
POWER
RADIO Socket
SP/MIC/PTT line.
MIC/PTT Socket
For HT MIC/PTT line.
POWER
Turns TNC on and off.
SP/IN Socket
For HT speaker line.
RS232 Switch
Turns on and off MAX232 chip to save power and to disable RS232 port.
LED Switch
Turns on and off LEDs to save power.

Figure 1. Details of the front panel of the HK-21.

There are also two radio connections on the front panel. The first uses a small telephone handset cord plug and includes the audio IN/OUT and PTT control lines. The unit has a miniature and subminiature plug for HTs.

The terminal connection uses a DB-25 connector and can be attached to a terminal or computer using an RS-232 level. The HK-21 cannot directly interface with TTL levels. Both *Xon/Xoff* software and RTS/CTS hardware flow control are available. The flow control will help you keep from losing characters when transmitting and receiving.

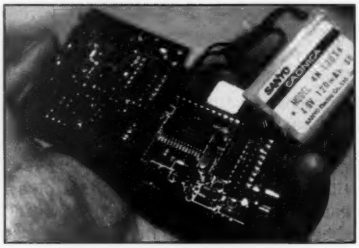

SANYO CADNICA

Photo A. Inside the HK-21.

Software Features

The HK-21 uses AX.25 software which you can set for the current level 2.0 protocol or the older Level 1. The unit is designed for 1200 baud VHF and UHF only; it will not work for 300 baud HF.

The manual states that the TNC uses the standard TAPR TNC-2 commands and is upload compatible. That is, if you have special terminal software designed to interface via TAPR TNC-2 standard commands, it should work.

The unit has an auto baud rate configuration for cold startup to get your terminal working with the TNC. Once you have the right baud rate, you can set the TNC to remember it on subsequent startups. The unit has a small internal memory backup lithium battery (not to be confused with the optional internal NiCd) which keeps your default command settings and PBBS data from disappearing when either the external or internal battery fails or is disconnected. The system has 32K of ROM

Photo B. The brains of the unit—the Z80A.

and 32K of RAM. The ROM contains the AX.25 and PBBS software (version 1.17 on my unit). The 32K of RAM contains, among other data, the system scratch pad memory, user command defaults, I/O buffers, PBBS data.

The PBBS

The personal Packet Bulletin Board System (PBBS) on the HK-21 is quite complete. You can post and retrieve personal and public messages. An outside computer isn't necessary; software and the storage of messages is part of the HK-21.

The system has about 15,000 bytes of storage for messages. Most of the messages I have on my system average about 225 bytes each. Based on this, the system will store about 65 messages. I don't think there is an upper limit to the length of a message, so a few long messages or computer listings could use up the memory. The unit was designed for a small personal PBBS, rather than a large, hard disk computer system.

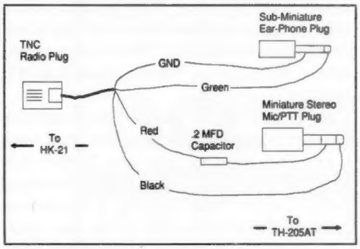


Figure 2. The TNC and HT work together by means of a telephone jack.

PBBS Commands

The table lists and describes the PBBS commands. The local terminal can use all the commands except HELP and BYE. If you have loaded the DAYTIME command with the current time and date at power-up of the HK-21, each message will be time-stamped. The time and date is kept by the computer within the HK-21, so when the unit is off, the current time and date information is lost. If you don't enter the correct time before connecting and sending (WRITE) a message, the time and date stamp will not be automatically attached to the description.

The PBBS has a callsign of its own. You set it up with the MYMCALL command. While it can have the same call as the MYCALL port, I find it is better to use a substation ID (SSID). I set my MYCALL to "N7KHU" and my PBBS MYMCALL to "N7KHU-1." This way someone else can use the PBBS while I am connected to other stations.

The PBBS can be activated and deactivated at any time on the local terminal by using the MBOD command. The PBBS does not lose any messages when it is turned off.

One of the nice features of the HK-21 is that you can store a message in the CTEXT buffer and instruct it to automatically disconnect after transmitting. A CTEXT message I sometimes use is: "I am not available, please connect to N7KHU-1 and leave me a message—73"

Before I go out, I set CMSG ON (send the CTEXT message) and CMSGD ON (disconnect after sending the CTEXT message). When a user connects to my node (C N7KHU), he gets the message in CTEXT, then he is disconnected. He then can connect to the PBBS (C N7KHU-1) and leave a message by typing W N7KHU. When I return home, I can turn on my local terminal and type MINE or MI to see if there are any messages, and use the R *n* (where *n* is the message number) to read the message. To delete a message, you use KILL *n*. Of course, you can connect to the PBBS via another packet radio system and list, read, and delete your messages. When you want to allow users to connect again, simply type CMSG OFF and CMSGD OFF.

Just like a large BBS system, the HK-21 PBBS keeps mail private. If you send a message to a specific call, only the sender and the receiver can read or kill the message over the air (however, the local terminal attached to the HK-21 can access and delete any message regardless of the sender and receiver callsigns). For public bulletins or messages, you can W ALL. Any station which connects to the PBBS can list and read public messages.

The HK-21 Manual

Heathkit documentation is known to be a cut above the ordinary. The HK-21 manual is one of the best TNC manuals I've seen. It is oriented to the new-to-average user of packet.

The first 30 pages tell you how to hook the TNC, radio, and computer or terminal together, and they give you tutorial sessions using all of the common commands. The bulk of the manual, 54 pages, details each of the HK-21 commands and their defaults, and describes how they work. The last few pages include a short troubleshooting table, command summary, schematic, and index.

The manual does not go into technical detail about packet radio or packet standards. To understand and use packet, you have to read some of the good books and magazine articles available on the subject.

I did find that the hook-up procedure for my Kenwood HT was not correct in the manual. I have a new TH-205A and it will not work with the directions given for Kenwood radios. This might be because the TH-205A is not like other Kenwoods. However, the general information and schematics were enough to get me by. See sidebar about the portable packet station using the TH-205A HT and the Tandy Model 100/102 laptop.

The schematic is very easy to read. The one drawback I found with it is that it should include placement of the jumper pads. Without this information, it's very difficult to tell the relationship between the PC board layout and the schematic.

The standard 8½" x 11" size of the three-ring binder makes the manual easy to copy and put in a binder with other equipment manuals and documents. The quality typesetting, graphics, paper, and printing give the manual a professional appearance. I always feel uneasy somehow about manuals printed by dot matrix.

Connecting the Radio

There are two ways to connect a radio to the HK-21. There is a miniature and subminiature phone jack intended for HT use. The PTT (push-to-talk) line is part of the microphone circuit. The second connection uses a small, 4-conductor phone plug (like the size used on a phone handset). This connector allows you to have separate PTT and MIC lines. This socket is intended for non-HT installations. In my case, I got my TNC and HT to work together using the telephone jack shown in Photo C. I used a small plastic barrel from a phono plug to house the 0.2 µF capacitor and to make the connections from the supplied HK-21 cable to the MIC/PTT and speaker cables (see Figure 2). Then I wrapped the barrel with electrical tape.

Photo C. The HT and TNC fastened together. Note the phone jack.

The computer cable I used for the Model 102 computer only needs lines 1, 2, 3, and 7 (pin 1 to 1, 2 to 2, etc.) because the internal TERM (terminal) program on the Models 100/102 is designed to handshake only with *Xon/Xoff* protocol. If you need to use the hardware

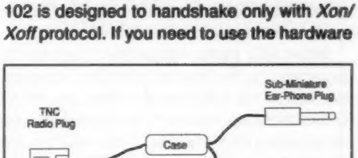


Figure 3. The TNC/HT interface physical layout.

flow control, you will need to use more lines. The HK-21 manual has instructions for most popular computers.

I use 1200 baud by setting the TERM STAT to "57E1E" on the Models 100/102 and setting ABAUD on the HK-21 to 1200. You can stop and start the display by entering CRTL S and CTRL Q in sequence.

There is one small problem with this system. The display will sometimes stop by itself. When this happens, the computer doesn't seem to want to talk to the TNC. If you type CTRL Q, the display will start again. This happens because the display on the Model 100/102 will not always keep up with 1200 baud packet. The computer automatically sends out an *Xoff* (CTRL S) when it needs to catch up. It then automatically sends an *Xon* (CTRL Q) when it is ready for more characters from the TNC. This seems to work just fine most of the time but, once in a while, either the computer doesn't send the *Xon*, or the TNC doesn't see it. The TNC just keeps waiting until you manually type CTRL Q.

The TERM software in the Model 100/102 allows you to upload and download ASCII text. You can also print out a hard copy. You can store files on a cassette tape or save them to disk with a 3½" disk drive.

Command	Mnemonic	Terminal *	Description
DAYTIME	DA	LOCAL	Used to set current time and date.
MYMCALL	MYM	LOCAL	PBBS call sign (and SSID)
MBOD	MB	LOCAL	Turn PBBS on and off.
BYE	B	RADIO	Log off PBBS.
MINE	MI	BOTH	List messages which are to you or from you. Gives message number, subject, time, and call (10 at a time).
FILE	FI	BOTH	Same as MINE except all messages are listed.
HELP	H	RADIO	Displays HK-21 PBBS help file.
?	?	RADIO	Same as HELP.
KILL	KI	BOTH	Kills a given message (by message number). Use a "%" or "&" instead of message number to kill oldest 10 messages.
READ	R	BOTH	Read a given message (by message number)
WRITE	W	BOTH	Write a message to a given station (by call sign). If no call sign given, message is to "ALL".

*** TERMINAL Codes**

LOCAL: Only computer or terminal attached to HK-21 RS-232 port can use this command.
RADIO: Only remote station using packet radio can use this command.
BOTH: Command can be used from either LOCAL or RADIO terminal.

NOTE: Mnemonics only used in LOCAL mode. The first letter of each command is used while remote station is connected to RADIO. Also, LOCAL mode inactive while a station is using the PBBS on RADIO.

The PBBS commands, with descriptions.

Concerns and Suggestions

As nice as the HK-21 is, there are a few "gotchas" that you should be aware of. Most are minor, some have to do with my preferences, and some might already be history by the time you read this.

First, my HK-21 came with mounts for the DB-25 connector hood that had the wrong threads. I informed Heath, and they sent me the right bushings. I don't know why I bothered to put the new bushings on; I don't screw the DB-25 hood on anyway! The HK-21 is so small and light, it will follow the connector and cord anywhere it wants to go (with or without the screws tightened).

The second problem was more serious. I was not able to use the TNC in my portable system on 145.01 because of a "birdie" or spurious signal introduced by the TNC into the HT radio. I found I could solve the problem by attaching an antenna mounted far away (like on the roof of the house). However, this was not suitable for portable and mobile use.

Contact with Heathkit produced the fix of putting a 5 pF capacitor across the 4.915 MHz crystal (connected to pins 65 and 66 of the IC-8 processor). This has allowed me to work the 144.99 and 145.01 MHz frequencies in my area. The birdie now shows up on 145.00, away from any packet frequencies.

While RFI (radio frequency interference) generated by the internal computer is a problem with all the TNCs I have owned, the HK-21 seems to be the noisiest. The plastic case has no shielding on the inside. If you have visions of using a short rubber duck antenna with the TNC strapped to the back to the HT, better think again. This configuration will not work unless you're right next to the station you're talking to. As mentioned in the description of my system, a more practical set up is to use an antenna a 3–12 foot distance from the HT, TNC, and computer. The farther away the antenna, the better the performance.

In my unit, I had some problems with the system memory losing its mind from time to time. I would lose all my PBBS messages and I would have to re-enter all my defaults. After this happened a few times, I looked inside and discovered that the battery had a loose connection to the PC board. After a quick solder job, the problem was fixed. The lithium battery should be good for at least 5 years.

There are small inconveniences one will find with any product this complex. However, there are two hardware features I find really annoying. First, the external power plug is on the side of the unit. For mounting in my case, it would have been better positioned on the back or the front of the TNC. In defense of the designers, I can see that the DB-25 plug takes up space on the back and the front panel is full! This brings me to my other annoyance.

> ***"The system is built around a Z-80A, software compatible chip."***

Why did the designers use a standard DB-25 on the back of the unit? It adds two inches to the length of the unit. A telephone plug similar to the radio input on the front would have been perfect.

The HK-21's software has been exceptionally dependable. The unit has never tripped off into never-never land. However, some small quirks are worth mentioning. First, you can change the date from MM-DD-YY to DD-MMM-YY with the DAYUSA command. This is used in the MHEARD list and for time-stamping packets. However, the command does not change the date format in the PBBS. This is especially confusing because, when you list messages with the FILE or MINE PBBS commands, the headers only show the day and month (MM/DD). Thus, 12/11 always means Dec 11, no matter how the DAYUSA flag is set. When you use the READ PBBS command, the date in the message header is given as YY/MM/DD.

As far as I can tell, the unit is not compatible with Net-ROM EPROMS. It doesn't have a KISS command for use with TCP/IP systems, nor does the unit work with HF 300 baud packet. While these features are available on other TNCs in this price range, the HK-21 was clearly intended to surpass the size, weight, and current consumption of the competition.

Support

I have contacted Heathkit twice about my HK-21, once by letter (phone lines were busy all afternoon) and once at the ARRL Convention in Portland, Oregon. Both times they were able to answer my questions and solve my problems quickly. I have been happy with the quality of the product and the service.

As far I as know, at $219.95, the HK-21 is the most expensive UHF/VHF single radio TNC on the market today. Add another $17.95 for the HKA-21-1, an optional internal battery pack. If size, a built-in battery pack, low current consumption, and a built-in PBBS are features on the top of your list, you might well feel it is worth the price. I did. For me, the HK-21 is the perfect TNC for my portable packet station.

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SHORT WAVE RADIO MANUAL

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Also included is a new chapter showing how you can use transistors to replace hard-to-find vacuum tubes. You'll even see the circuit that was lashed together on a table top one night using junk box parts, a hair curler and alligator clips. Attached to an antenna strung across the basement ceiling and a 9 volt battery, signals started popping in like crazy. In a couple of minutes an urgent message from a ship's captain off Seattle over 1500 miles away was heard asking for a navigator to help him through shallow water!

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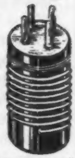

PACKET TO GO
N7KHU

To get a good idea of how you can use the portable features of the HK-21, you really need to see an example of a portable packet system. I have assembled a system which I use in my car (while parked), on out-of-town trips, during field day, and as a secondary home system. In Photo SA, the computer is removed, and you can see the complete system. The system contains the following equipment and hardware:

- 1 Kenwood TH-205A 5 Watt, 3 channel, 2 meter HT radio
- 1 Heathkit HK-21 "Pocket Packet" TNC
- 1 Radio Shack 32 KB Model 102 laptop computer
- 1 Pelican #1400 Waterproof Case w/optional panel mounts
- 2 Radio Shack #23-181 6 V, 2.5 Ah Gel-Cell cellular radio batteries
- Hook-up cables

Photos SB and SC show the internal case construction. I found that having the external antenna cable directly attached to the HT was inconvenient. I bought a female-to-female chassis mount connector and drilled a hole just below the handle. The connector could have gone anywhere on the case, but I chose this position because of the internal layout of the components and the protection this area gave to the BNC jack.

In Photo SC you can see that I separated the batteries from the main equipment compartment with a piece of ¼" plywood. I glued it in place with quick-set epoxy (Radio Shack #64-2313). I glued the bottom foam liner, which came with the case, with contact cement to the main compartment and the battery partition. The partition and the foam gives the HT and TNC protection during transport.

The M102 computer rests above the equipment on mounting tabs, available directly from Pelican. The store I bought the case from knew nothing about them. Position the tabs 1¼" from the top of the bottom compartment. I used the quick-set epoxy to attach these tabs.

The Pelican case is available at many camera stores or by mail order (see the ads in camera magazines). There are holes for a lock on the case for security. However, I always put the case in a cardboard box when shipping it as checked baggage. This keeps the case from getting scuffed up. Also, the case looks valuable and is an invitation for theft.

Figure S1 is a schematic of the general hookup. The 6 volt batteries are wired in series and use an inline "cigarette" type power jack (see Photo SD). The power cable for the HT and HK-21 has a matching power plug. This way, the HT and TNC can be powered from a car with the cigarette lighter outlet.

Photo SD also shows the complete hookup outside the case. Note that the antenna cord is not attached to the radio. The inline fuses on the batteries are hard to see in the photo, but they are shown in the schematic.

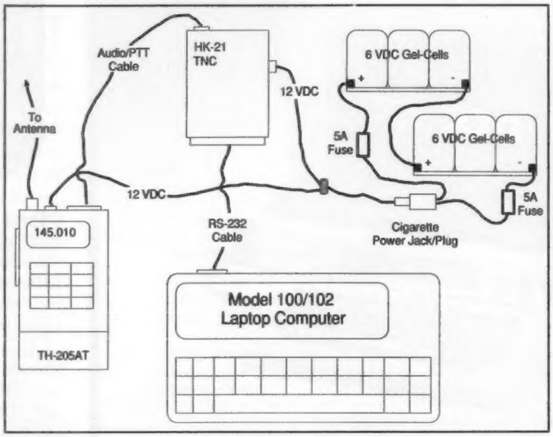

Figure S1. Schematic of the hookup, showing the batteries in series.

I use the 12 volt DC batteries because they will allow a full 5 Watts output on my HT and allow much longer usage compared to the HT battery packs. The life of the battery is about six to eight hours, depending on transmit time and battery temperature. I charge the battery using an A&A "Smart" Gel-Cell charger which I have set for 12 volts DC at 250 mA charge current. With this type of automatic charger, you can let the batteries charge indefinitely without damage. However, you can use a 200 mA to 500 mA 12 volt DC battery eliminator to charge the batteries if you watch the condition of the charge. You can do this by measuring the voltage across the battery while charging. Once the voltage reaches about 13.75 volts, the batteries are charged.

Overcharging will shorten the life of Gel-Cells. Gel-Cells do not take kindly to being discharged deeply, either. They like to be always fully charged, and they will last longer if you charge them soon after use, and don't discharge them below the level at which the HT "low battery" indicator lights up. My next project will be to mount a solar panel directly to the top of the case and charge the batteries with the sun!

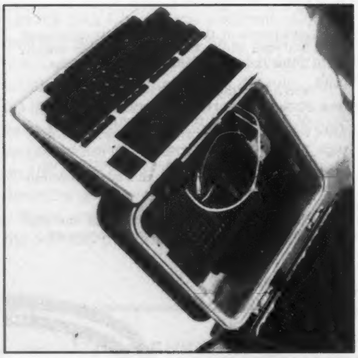

Photo SA. The complete system, with the computer removed so that you can see the TNC, HT, and battery compartment.

Antennas

I have tried a number of antennas with this system. The two I use the most are a portable J-Pole antenna, the SPARKY-J sold by Antennas West, and a quarter-wave mag mount.

The SPARKY-J unit is flexible and folds up to fit inside the case. You can attach it to a wall or place it outside. For best results, the antenna should be as high as possible and away from any metal objects. Tossing some twine over a tree branch and hoisting the antenna up works great for me. For more information about the SPARKY-J 2 meter antenna, contact *Antennas West, PO Box 50062-W, Provo UT 84605. Phone (801) 373-8425.*

I also use a mag mount quarter-wave antenna on the car. The quarter-wave performs well, but it requires a large metal object, such as the car, for a ground plane. The J-Pole needs no ground plane.

Photo SB. The external antenna cable is not connected directly to the HT.

Photo SC. Construction of the separate battery compartment.

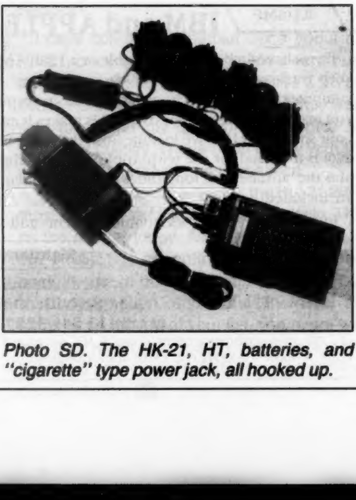

Photo SD. The HK-21, HT, batteries, and "cigarette" type power jack, all hooked up.

Breadboard a VCXO

Continuous 10 meter coverage from your CB.

by Walter R. Stringer N8BSG

Novices, and Technicians, of which I am one, may operate CW and other digital modes from 28.1 to 28.3 MHz, and CW and SSB from 28.3 MHz to 28.5 MHz. All the reported activity on this band lately made me want to get involved.

CB-To-10

To successfully convert my Lafayette Telsat SSB-120 citizens band transceiver over to 10 meter operation, I needed to build a voltage-tuned variable-frequency crystal oscillator (VXO) that could be varied over a 5 kHz range without losing its crystal stability. What I built, however, might be useful to anyone who desires a VCXO (Voltage-Controlled Crystal Oscillator). This mod helps you get the most frequency swing possible with a voltage tuning range of 0.0 to 12.0 volts. In my case, it led to continuous 10-meter coverage.

On the amateur 10 meter band, only the upper sideband is used for voice modulation. For CW operation, the AM mode could be used to cause the transceiver to output a carrier by keying the PTT (push-to-talk) line and not applying any modulation via the microphone. The same offset crystal is used for both USB and AM modes in most, if not all, SSB CB radios (including the one that I converted) so that, for a successful conversion, I had to worry only about getting one crystal frequency changed and working properly.

The Hitch

The CB channels, however, have a spacing of 10 kHz between them, and therefore the transceiver's PLL (phase-locked loop) circuit switches in 10 kHz steps. All SSB radios have a "fine-tune" or "clarifier" control on them for tuning in received signals, and there are conversions to allow that circuit to work during transmit as well. CB City International (PO Box 31500, Phoenix, Arizona 85046) is a very good source of CB-to-10 meter conversion information. Also check with *73 Magazine* for their list of 35–40 articles on CB-to-10 conversions.

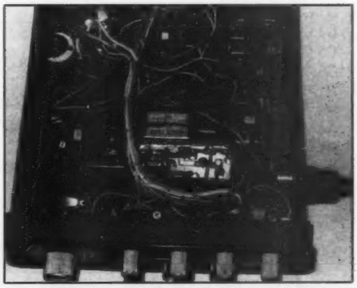

Photo A. The completed oscillator-buffer nestled in the converted CB transceiver, at front center of the rig. Tape the bottom of the board to prevent shorts.

For operation on the amateur 10 meter band, you need continuous frequency coverage, and to get that, you need to make each channel frequency-agile to the tune of 10 kHz, plus fill in any "missing channels". Fortunately for me, the output of the oscillator is doubled by the radio's circuitry, so even if I could get only 5 kHz of total oscillator swing I could cover the entire 10 kHz-wide channel. Now all I had to do was try to build a crystal oscillator that could be voltage-tuned over a 5 kHz range.

The Answer

The approach I used was to "breadboard" an oscillator circuit. When I got everything

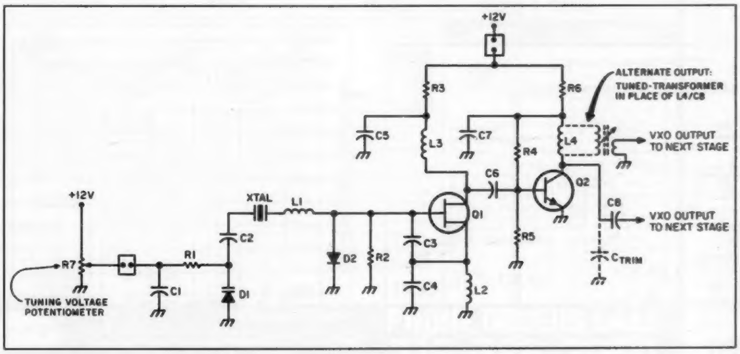

Figure 1. Schematic for the VCXO modification.

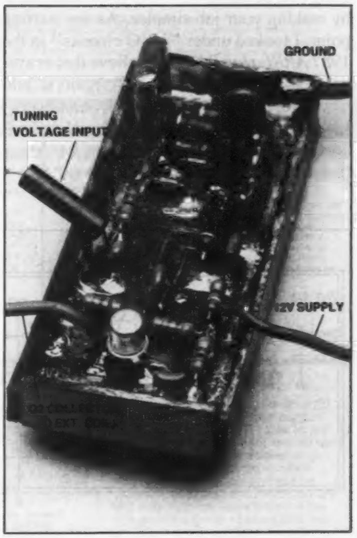

Photo B. The assembled VCXO mod.

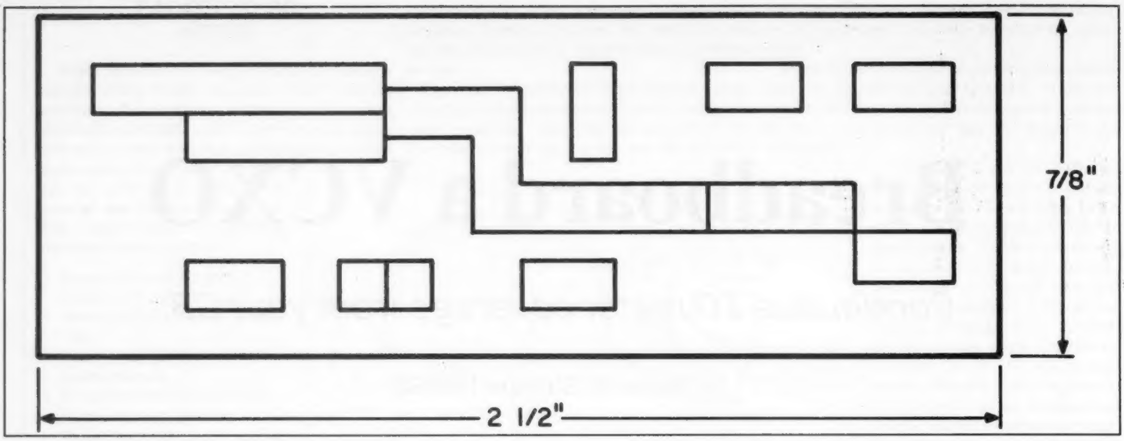

Figure 2. PC board foil diagram for the VCXO mod. The enclosed sections on the board are foil. Score between the sections with an X-acto knife.

working right (the frequency swing that I desired and sufficient output level), I installed it in the radio for the final test.

Figure 1 is the schematic of the VCXO mod. Figure 2 shows the etching pattern of the board. This can be "etched" with a ruler and an X-acto knife, or with a Dremel tool with a broken drill bit used as a router (my method). Figure 3 shows the parts placement on the board. Note that at the four sides of the board are strips of PC board soldered to join together the top and bottom ground planes of the double-sided printed circuit board. Photo A shows the completed oscillator-buffer installed in the converted CB transceiver. It may be necessary to put electrical tape on the bottom of the circuit board to prevent it from shorting anything out.

It is always good to first consult a reliable reference book when you are setting out to make a mod. Even if you don't find exactly what you are looking for, you may find something that does most of what you want, thereby making your job simpler. As my starting point, I looked under "VXO circuits" in the 1987 *ARRL Handbook*. (I believe that everyone who experiments with RF circuits should own a recent copy of the *ARRL Handbook*.) Included are "practical examples of crystal-controlled oscillators that can be frequency trimmed."

Crystals

I ordered two crystals of the same frequency—a 32 pF load capacitance (which is what is commonly used), and a 10 pF load capacitance. Both were HC-18/U style holders with wire leads from Marden Electronics Company, Inc. (PH: 800-222-6093). Even with 5-day "rush shipping," the cost was pretty reasonable, and I've had good luck with crystals from them. As it turned out, under identical conditions, I got 300 Hz more swing from the 10 pF crystal (3.9 instead of 3.6 kHz) and, since it would oscillate higher in frequency, I could tune it above and below the desired center frequency. With a 32 pF crystal, all or most of my range would be below the desired center frequency.

Parts List
Voltage-Tuned Crystal Oscillator

Q1	MPF-102	FET
Q2	2N2222A	NPN
D1	MV-209	Varactor Diode
D2	1N4148	
XTAL	10.32625 MHz Crystal, 10 pF Load Capacitance	
L1	10 µH	Coil
L2,L3,L4	100 µH	Coil
C1,C2	0.001 µF	Capacitor
C3,C4	25 pF	Capacitor
C5,C7	.01 µF	Capacitor
C6,C8	100 pF	Capacitor
R1,R2	100kΩ 1/4 Watt	Resistor
R3	390Ω ¼ Watt	Resistor
R4	47kΩ ¼ Watt	Resistor
R5	4.7kΩ ¼ Watt	Resistor
R6	470Ω ¼ Watt	Resistor
R7	50kΩ	Tuning Potentiometer, Linear Taper

One 2½" x ⅞" piece of double-sided printed circuit board

Two 2½" x ¼" pieces of double-sided printed circuit board

Two ⅞" x ¼" pieces of double-sided printed circuit board

The Right Varactor

I used a varactor diode in series with a .001 mF cap in place of where the trimmer cap would go to make the oscillator voltage-tuned. A crystal will block DC, so the .001 mF cap may seem unnecessary, but I prefer to use it anyway to prevent applying DC tuning voltage to the crystal.

I tried several different varactor diodes in the circuit to see which would give me the most frequency swing over a 0.0–12.0 volt range, and the best was the varactor diode that was used to modulate the 1.7–1.8 MHz RF carrier of an old Radio Shack cordless phone base unit.

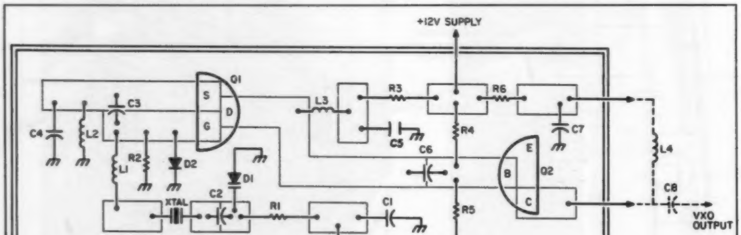

Figure 3. Parts placement for the VCXO mod.

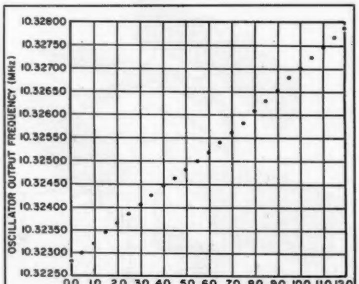

Figure 4. VCXO frequency output versus voltage tuning range. It is a very linear function.

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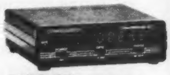

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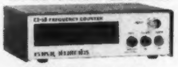

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CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 Mhz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.95

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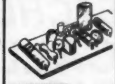

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Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

Transmitter kit, LB-6 **$8.95**
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HIGH POWER FM WIRELESS MIKE

A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output allowing you to hit the repeaters full quieting while the low noise preamp remarkably improves receptions. Ramsey Electronics has sold thousands of 2 mtr amp kits but now, we offer completely wired and tested 2 mtr as well 220 MHz units. Both have all the features of the high priced boosters at a fraction of the cost.

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CIRCLE 34 ON READER SERVICE CARD

A Motorola MV-209 varactor diode turned out to be almost as good. This is rated to up to 30.0 volts maximum. The diode is reverse-biased in operation. As the tuning voltage increases so does its capacitance, which in turn decreases the oscillator's frequency. If you wish to go up in frequency as you turn the fine-tuning (or clarifier) knob clockwise, you must wire the potentiometer up so that as you turn it the tuning voltage to the varactor diode decreases.

I experimented with the value of L1 until I got the most frequency swing without losing the crystal stability (this is obvious when monitoring the oscillator's output with a frequency counter, as the oscillator frequency will suddenly take off). L1 adds about 400 to 500 Hz additional frequency swing.

The 1N4148 diode (D2) limits the amplitude of the RF at the gate of Q1. While this does decrease the output level of the oscillator, it allows approximately 1 kHz more swing than without it (3.9 instead of 2.9 kHz).

Which Coil?

The coil (L2) in the source circuit of Q1 can be anything from 100 µH to 1 mH. A 560Ω resistor there in place of a coil will result in an output with much less harmonic content (great, if you are interested in only the crystal's fundamental frequency). Any coil within the above range will give a slightly better frequency swing than the resistor.

Capacitors C3 and C4 are in series with L1, the crystal, C2, and the varactor tuning diode. Since in a series circuit the total capacitance will not be any larger than the smallest capacitance, C3 and C4 should be as large as possible, which allows the varactor diode to be the dominant influence on the frequency of the oscillator. The other limitation on the values of C3 and C4 is that, since any kind of trimmer capacitor across the crystal would limit the frequency swing of the oscillator, they together tune the crystal to the desired center frequency. When using the Colpitts crystal oscillator, I prefer to keep both feedback capacitor values the same, although many other places specify that the "bottom" (source-ground) capacitor be 3 times the value of the "top" (gate-source) capacitor.

In Praise of Buffers

I built a buffer stage to follow the oscillator. When working with oscillators for RF, I recommend always building a buffer stage. The cost of the extra transistor and parts is next to nothing, and you can use the buffer stage to really build up the level of your signal and also to filter out unwanted harmonics. The buffer stage also serves as a constant load for the oscillator. This way, all the oscillator has to do is oscillate, which is very important if you are trying to optimize it for something, such as for maximum frequency swing. When I installed the oscillator in the radio, I took out L4 and instead wired into the circuit the tuned RF transformer for the offset oscillator stage.

You can tune the buffer stage output by adding a trimmer cap, CTRIM, from the collector of Q2 to ground, which will resonate with L4. The same thing could be done with a trimmer cap from the drain of Q1 to ground, which will resonate with L3. At 12.0 volts, Q1 draws less than 0.5 mA, and Q2 draws 28 mA.

The oscillator's frequency output over the voltage tuning range is quite linear, as the chart (Figure 4) shows. Your "fine-tune" or clarifier potentiometer must be a linear type, however, as using an audio taper type will cause all of your range to be at one end of the dial.

Ultimately, with all of the experimentation, I was able to get 5.04 kHz of frequency swing out of the oscillator at the crystal's fundamental frequency.

Finis

During my conversion and troubleshooting I tested the rig in the AM mode with the PTT line keyed on and, with no modulation applied, measured all my frequencies on all my channels. A 10 meter SSB on-the-air test with my converted unit showed the conversion to be working fine.

So, there it is—a fun and cheap way to get a channelized CB on 10 meters. This band will be hot over the next few years, so I hope this mod will help you get in there and make good use of it! ■

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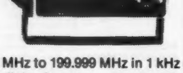

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Feed Point Protection

A little help for your bumper-mounted antenna.

by W. C. Cloninger, Jr. K3OF

Several years of heavy mobile HF operating (100,000 miles and 100+ countries) can reveal much about mobile antennas and bumper mounts. I have used a number of different mobile antennas and combinations, including the regular Hustler resonators in both single and "candelabra" configuration, the Swan M34 multiband antenna in three and four band configurations, and finally a homebrew multiband antenna. ("Four Bands, One Whip," *73 Magazine*. April 1984, page 56.)

The performance of each antenna and combination was satisfactory and none seemed to offer any dramatic difference in either transmitted or received signals. There are some differences in bandwidth from one antenna to another, but my HF transceivers (solid state) did not substantially reduce output power until SWR was well above 2:1. Some of today's HF transceivers are much less tolerant of reflected power than the Atlas 210X and 210XLE's that I used. In the best of conditions, a mobile antenna is no match for your tribander at sixty feet, or even a good dipole, but mobile antennas still perform remarkably well with reasonable band conditions. Still, you want to ensure their continued peak performance.

Real Antenna Turn Off

I used only the Hustler bumper mount, but this one and a number of other mounts expose the feedpoint of the antenna to the elements. This feedpoint exposes these mounts to severe problems, particularly in winter weather. The culprits are wet dirt and salt. They will drop a S9+20 signal to an S5 or less. This will also play havoc with your transmitted signal, particularly if your HF transceiver is sensitive to SWR. Once salt has coated the antenna mount, it does not even have to be wet to cause problems. Ambient humidity provides enough moisture to allow the salt to conduct well.

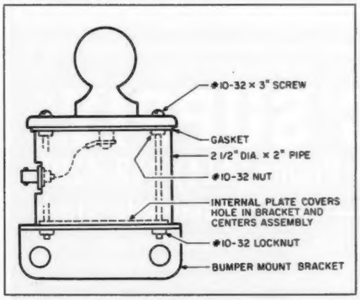
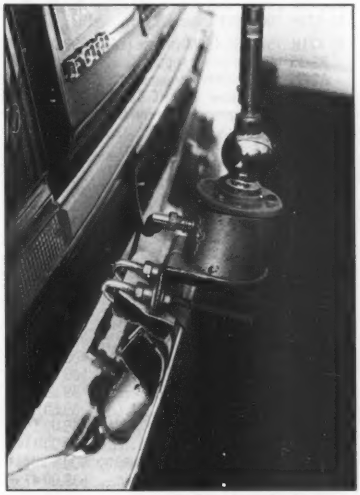


Figure 1. Assembly details of protected mobile antenna mount.



A BNC connector for the enclosure makes it easy to attach coax to the mount.

The Solution

I solved this problem by protecting the antenna feedpoint from exposure to rain, dirt, and salt. I modified the Hustler mount to protect the antenna feedpoint by making an enclosure. I also added a BNC connector to the enclosure to make it easy to attach coax to the mount (see photo). BNC connectors are weather resistant, as are several other types of connectors. The ease of removing or attaching the coax was important to me because I have used the Hustler mount on at least ten different vehicles.

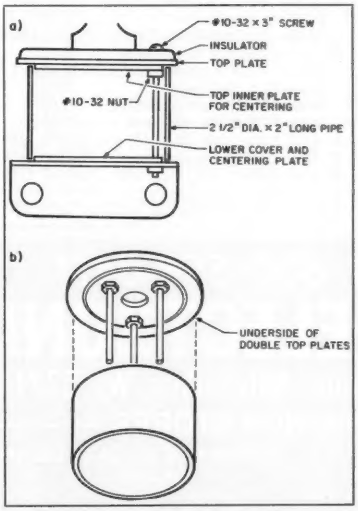

a)
#10-32 × 3" SCREW
INSULATOR
TOP PLATE
#10-32 NUT
TOP INNER PLATE FOR CENTERING
2 1/2" DIA. × 2" LONG PIPE
LOWER COVER AND CENTERING PLATE
b)
UNDERSIDE OF DOUBLE TOP PLATES

Figure 2. Alternate construction. This doesn't require welding.

Construction

Figure 1 shows the construction of the enclosure I made for the Hustler mount. The core is a 2-inch section of 2½-inch diameter automotive exhaust pipe. I welded a top plate to the cylinder and cut out a section in the side of the pipe where I welded in a flat section to provide a good mounting surface for the BNC connector. For readers who don't have access to welding facilities, see Figure 2. This shows a non-welded method of construction. The plate at the bottom of the cylinder covers the large hole on the mount bracket and also helps center the cylinder assembly (Figure 3). There is no attempt to seal the bottom plate, as it easily keeps water from splashing into the enclosure and will allow any water which may seep in to run out the bottom. Paint all parts of the assembly to prevent rust.

The original Hustler gasket is used at the top of the mount. 10-32 x 3-inch screws secure the expanded assembly. Extra nuts and lock washers inside the cylinder at the underside of the top plate add stability to the assembly. Then assemble the ball mount and attach the center conductor wire from the BNC connector to the feedpoint on the ball mount stud.

The completed assembly is now attached to the bumper bracket with self-locking nuts, and the protected antenna mount is ready to pull in all those DX signals in all kinds of weather! ■

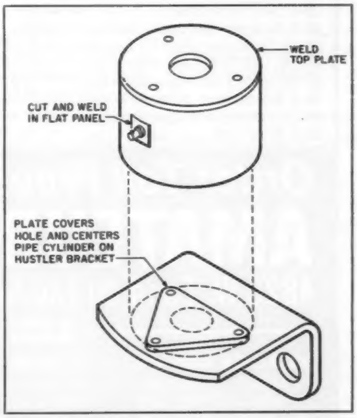

WELD TOP PLATE
CUT AND WELD IN FLAT PANEL
PLATE COVERS HOLE AND CENTERS PIPE CYLINDER ON HUSTLER BRACKET

Figure 3. Lower plate covers hole in bracket and aids in centering the enclosure cylinder.

HF Equipment	Regular	SALE
IC-781 Xcvr/Rcvr/ps/tuner/scope	5995.00	Call

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FL-101 250 Hz 1st IF CW filter	73.50	
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FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	

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FL-32A 500 Hz CW filter (1st IF)	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	109^{95}
FL-53A 250 Hz CW filter (2nd IF)	115.00	109^{95}
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FL-70 2.8 kHz wide SSB filter	59.00	
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PS-55 External power supply	219.00	199^{95}
AT-150 Automatic antenna tuner	445.00	369^{95}
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EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

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PS-30 Systems p/s w/cord, 6-pin plug	349.00	319^{95}
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SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
PP-1 Speaker/patch	179.00	164^{95}
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	139^{95}
AT-100 100W 8-band auto. antenna tuner	445.00	389^{95}
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IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	1099
IC-475H 75W 440 FM/SSB/CW	1599.00	1289
IC-575A 25W 6/10m xcvr w/ps	1399.00	1129
IC-575H 100W 6/10m xcvr	1699.00	1499
IC-471H 75W 430-450MHz base (c/o)	1399.00	989^{95}
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AG-35 Mast mounted preamp	99.95	
AG-35 (Purchased with IC-471H)	99.95	9^{95}
SM-6 Desk microphone	47.95	
EX-310 Voice synthesizer	59.00	
TS-32 CommSpec encode/decoder	59.95	
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IC-38A 25W 220 FM, TTP mic	489.00	349^{95}
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IC-48A 25W 440-450 FM, TTP mic	509.00	449^{95}
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UX-49A 440MHz 25W band unit	349.00	319^{95}
UX-59A 6m 10W unit	349.00	319^{95}
UX-129A 1.2GHz 10W band unit	549.00	499^{95}
IC-1200A 10W 1.2GHz FM Mobile	699.00	549^{95}
IC-3200A 25W 2m/440 FM/TTP (c/o)	695.00	499^{95}
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IC-3210A 25w 2m/440 FM/TTP	739.00	649^{95}
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IC-u4AT 440 MHz, TTP	369.00	299^{95}
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BC-35 Drop in desk charger for all batteries	79.00
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LC-14 Vinyl case for Dlx using BP-7/8	20.50
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Accessories for IC and IC-O series	Regular
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73 Review

by Pete Putman KT2B

Yaesu FT-790RII All-Mode Transceiver

Go mobile at the drop of a hat.

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Price Class: $800

Yaesu has consistently come up with innovative transceiver designs, from full-featured HF transceivers to dual band VHF/UHF hand-helds. Yaesu offers a line of portable all-mode radios for VHF operation, and we've reviewed the other two in the last year: the FT-60RII for 6 meters and the FT-290RII for 2 meters. The combination of a mobile, base, and portable transceiver all in one package is very appealing . . . especially for those of us who like to operate portable at the drop of a hat.

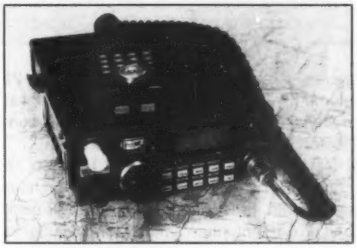
Now Yaesu has added a new face to the line with the FT-790RII, an all-mode transceiver for 430–450 MHz operation. It uses the same accessories as the 690R and 290R, is the same size, and pretty much operates the same way—which is to say it does its job very well even under some fairly adverse conditions. The 790R is quickly distinguished from its two cousins by the distinctive blue nameplate which reads "UHF" under the front panel BNC connector.

Overview

The front panel layout is very simple. Concentric knobs control power on, volume, and squelch. The largest knob controls frequency tuning and is directly below a miniature RF output/signal strength meter. Eight buttons below the main display do the bulk of the work, controlling the dual VFOs, the ten memory positions, high/low power, repeater offsets, noise blanker, tuning speed, and mode operation among other things. A clarifier (RIT) control is located to the extreme right of the front panel above the microphone connector.

The supplied MH-15C8 DTMF microphone also allows the operator to step through the memories or shift frequency with the UP/DWN buttons. These controls can be locked out via a rear panel switch if desired. An optional MH-10F8 speaker/microphone is also available without the DTMF function. Miniature phone jacks on the side of the radio allow connection of a remote speaker and a CW key (keying is automatic), and the front panel BNC connector is used for a whip antenna. Otherwise, a type N fitting on the rear housing is the standard antenna connection.

One comment regarding the microphones: It has been my experience with two of the MH-15C8 microphones that they do not hold up well under normal use. The first unit would not transmit anything remotely resembling a DTMF signal, and the LOCK switch on the second would not function correctly. The microphone supplied with the FT-790R has neither of these problems, however.



The Yaesu FT-790RII is ideal for mountaintop UHF operation and makes a light package with the accessory FBA-8 battery case.

What makes the FT series unique is the modular approach used throughout the line. For mobile or base station use, the FL-7025 amplifier is connected to a battery or DC supply and up to 25 Watts output is available. The FL-7025 contains a power module and DC control circuitry wrapped up in an extruded aluminum housing that doubles as a heat sink, and is attached by two large latches to the body of the 790R. It's a small package and can be installed easily in most automobiles.

Takin' It With You

For portable operation, the user snaps the two latches to remove the FL-7025 pack. He then attaches the accessory FBA-8 battery pack using the same two latches and he's ready to go. The FBA-8 pack uses 9 C-size NiCd or alkaline cells and operation of the 790R is identical except for three things: (1) Power output is much lower, (2) The front panel lamp is disabled, and (3) The antenna must be connected through the front panel.

Power output with the battery pack is typically 3 Watts on high power. Is that enough for portable communications? For FM simplex and repeater work, it's more than enough. How about on SSB or CW? We'll find out in a moment.

Although the meter lamp is disabled, a button on the rear of the FBA-8 pack allows you to turn it back on momentarily or permanently—but at a higher rate of battery depletion. Yaesu supplies a flex antenna for the 790R called the YHA-44D which is fine for simplex or repeater work. For weak-signal operation, however, something with a bit more gain is called for at the BNC jack.

The FT-790R is equipped to store up to 10 frequencies in memory. The memory positions also store and recall repeater offsets, operating mode, and subtone settings from the FTS-7 subtone encoder. Note that only one subtone setting is possible with the FTS-7, and you will have to access the board through the rear of the main housing to make any changes.

The FT-790R offers three scanning options: VFO scanning, activated from the UP/DWN switch on the microphone; memory scan, which can scan all 10 memories or ignore any locked-out channels; and programmable scan, wherein memory positions 1 and 2 are used to define an upper and lower band segment to scan and tune through. Priority channel operation is also offered as is duplex operation for non-standard offsets.

You can select all of these functions from that 8 button keypad using a function shift key, marked clearly with a large "F" on an orange button. After using the radio for a bit, you can get good enough with these buttons to find the right combination without looking! All button strokes are reinforced with the usual audible "beep" and the "F" key has a distinctly different pitch.

The FT-790R covers the 70 cm band in two segments: 430–440 MHz, and 440–450 MHz. When in the first range, the display reads normally. Operation in the second range is indicated by the word "HIGH" under the VFO or memory indicator.

Three tuning speeds are available for each mode. In SSB/CW modes, the tuning rates are 25 Hz, 100 Hz, or 2.5 kHz per increment . . . more than adequate when used with the clarifier control. In FM mode, the steps are 12.5 kHz, 25 kHz, or 50 kHz. High speed motion around the dial is accomplished with the UP/DWN shifted push-button, which moves in 1 MHz steps.

Performance

As is the case with many small radios, the meter indications on the 790R don't reveal much. Early 290R and 690R owners complained that RF output was very low for the given microphone gain setting, and it took lots of voice to move the meter. Similarly, received stations that appeared to be quite strong hardly budged the S-meter.

Let's dig a bit deeper into these issues. First, the RF power output is determined by one internal control, functioning as an ALC adjustment. The stock 290R could put out as much as 30 Watts by readjusting this control, and it appeared that SSB voice peaks were much higher on the front panel meter. However, the accuracy and response of such a small meter is not to be trusted. Inspection with both peak-reading and average-reading precision RF wattmeters indicated that the 290R was doing the job. And so it is with the 790R (see Data Table).

The second complaint pertains to the S-meter, and here it is well-founded. Received signal strength indications are lower than would be expected with the test signals used. All three of the FT series radios suffer from this malady, and I've also seen it on the ICOM '75 series VHF radios that sell for more than twice the cost of a 290R or 690R! Fortunately, you can recalibrate the meter if an accurate signal generator is available to a more realistic setting.

Performance Data
Yaesu FT-790RII Transceiver

Specification		Claimed	Measured
Receiver Sensitivity:	10 dB S/N SSB, CW	0.2 µV	0.16 µV
12 dB SINAD FM		0.25 µV	0.2 µV
Selectivity, -6/-60 dB:	SSB/CW	2.4/5.2 kHz	n/a
FM		12/25 kHz	n/a
Squelch Law:	SSB/CW	n/a	.45 µV
FM		n/a	.12 µV
Signal required for 'S9':		n/a	3.5 µV
Transmitter Output:	High Power, FL-7025	25 W @ 8 Amps	25 W
Low Power, FL-7025		n/a	4 W
High Power, FBA-8		2.5W @ 1.5 Amps	3 W
Low Power, FBA-8		n/a	350 mW

All measurements made with the following equipment: HP 608F generator, Bird 43 Thruline wattmeters, Bird Termaline coaxial resistor, Boonton 92 RF voltmeter.

In Actual Use

The 790R got its first big test during the 1988 ARRL UHF contest, where it and the 290R were backpacked up Cathead Mountain in the lower Adirondack Park of New York State. We fell twice on slippery rocks but the radios only suffered a mild jolt. It was wet and the threat of rain was constant, so conditions weren't exactly pleasant. I put up a Tonna 21 element yagi on two sections of 5 foot mast material and ran it directly into the BNC connector.

When not on 903 and 1296, I logged 15 contacts in 9 different grids in a four hour period with three Watts from the FBA-8 pack and a 16 dB antenna . . . mostly on SSB. Some of these contacts were made over paths exceeding 150 miles with S9 + 20 reports on both ends. The 790R certainly hears very well, especially with a good yagi in front of it. And 3 Watts? Plenty of RF, especially when you go mountain-topping! Receiver selectivity is surprisingly good, and dynamic range about average. Some hashing of the front end was observed from a nearby high-power multi-op station, but the sharp antenna helped considerably.

Conclusions

Easy! Another winner from Yaesu. If you like to operate 70 cm portable anywhere—camping, at the beach, on a boat—this is the transceiver for you. The small size of the 790R lends itself to any number of operating situations, and it packs a lot of punch for its size, whether you use the FL-7025 amplifier or go barefoot with the FBA-8 pack. Best of all, the price won't break your budget. ■

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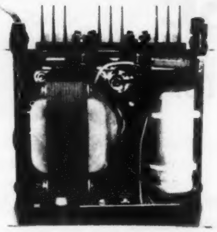

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MODEL VS-50M

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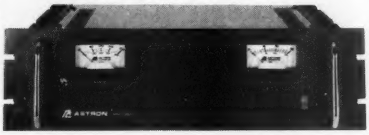

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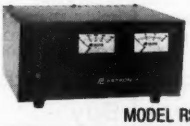
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

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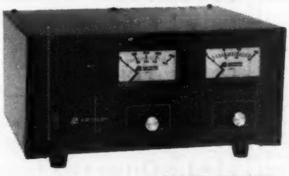

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VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Mnemonic Morse

Code-hating computerniks take note!

by Roger B. Keeney W8LHL

A fellow Civil Air Patrol communicator called my attention to G. Harold Love's article, "Code Test Sure Shot," on page 10 of the July 1988 issue of *73 Magazine*. After starting off with some simple mnemonics to nail down the first few letters of the code, he then explained how to do a bit of contextual analysis to reconstruct the rest of the typical QSO-type message that had been copied as vertically written dots and dashes during the Novice code test itself.

Initial Ponderings

It occurred to me that there might be folks out there more interested in using their computers than their code keys to communicate by radio. A set of simple mnemonic phrases coupled to the letters of Morse code arranged in binary order would simplify matters greatly. As G. Harold Love suggested, "off-line" translation would be accomplished by copying the dits and dahs with vertical pencil strokes.

Disclaimer

Before continuing, a few words about no-code. The idea of a no-code license does not seem to be popular with the majority of the radio amateur community...yet. There are raging arguments on both sides. One of the best arguments going for CW is its DX capability, possible with the simplest equipment. Another is our obligation to maintain our proficiency at CW in the case that it's the best thing going during an emergency.

One of the arguments against no-code is the fear of having the ham bands trashed by no-coders in the same manner that CB was. Another fear seems to be seeing another person with a hand-held turn out to be just a radio operator, rather than a kindred soul who could talk with you, on your level, of the exhilaration of breaking through or avoiding the pileups by using CW.

My argument is that there's a pool of talented people who could make significant advancements in digital communications if they weren't being held back because Morse code might not be their bag—and I think that's ham radio's loss more than it is the computer hobbyists'.

The Evolved System

With this soap boxing out of the way now, let's get on with laying out the Morse code with the first sentence: "Even then, I ask no more." Notice how I'm portraying the dits and dahs vertically, which Love says is a much faster way of writing them. The initial letters are E (.), T (|), I (..), A (.|), N (|.), and M (||). Adopting the convention of dits being binary zeros and dahs being binary ones, we count off the two single-element letters (which makes E a binary zero and T a binary one) and then the four letters composed of just two elements. Thus I, A, N, and M count off binarily now as zero, one, two, and three.

2^3

Looking next at the three-element letters, we find eight of these. Counting off binarily from zero to seven we have S (...), U (..|), R (.|.), W (.||), D (|..), K (|.|), G (||.), and O (|||). The mnemonic sentence for these eight letters would be "Sing utterly real words; don't knock golden oldies." Like that? Hang in there, Morse fans. This gets even better when we get into the big league—four-element letters!

2^4

Now we're getting into the heady stuff, 16 letters made with four elements each. That's four bits batting out zero to 15 in the language of computers. Let's take the first eight, all starting with that first dit. H (....), V (...|), F (..|.), * (..||), L (.|..), * (.|.|), P (.||.), J (.|||). Notice that we have a couple in there that aren't ours. The letters depicted with asterisks do exist in one form or another in other languages such as Russian, Greek, or Arabic, whose larger alphabets are very glad to have our castoffs. So, when we go to make up our sentences, we will incorporate these foreign characters as dramatic pauses in our own continuing mnemonic English dialogue: "Have valued friends (pause) Laugh! (pause) Play jazz!"

We're on the home stretch now with the last eight beginning with dahs (actually six English and two more foreign): B (|...), X (|..|), C (|.|.), Y (|.||), Z (||..), Q (||.|), * (|||.), * (||||). Bet you're wondering how we get the characters like X, Z, and Q into this final act, aren't you? So to the finish line we go with "Buy xylophones; create your zestful quartet (long) (pause)."

The real kicker's yet to come, but let's look at these four lines all together once before going on to the encore (see Figure 1):

Even then, I ask no more.
Sing utterly real words; don't knock golden oldies.
Have valued friends (pause) Laugh! (pause) Play jazz!

•	Even	•••	Sing	••••	Have	I•••	Buy
I	Then	••I	Utterly	•••I	Valued	I••I	Xylophones;
••	I	•I•	Real	••I•	Friends	I•I•	Create
•I	Ask	•II	Words;	••II	(pause)	I•II	Your
I•	No	I••	Don't	•I••	Laugh!	II••	Zestful
II	More	I•I	Knock	•I•I	(pause)	II•I	Quartet!
		II•	Golden	•II•	Play	III•	(long)
		III	Oldies	•III	Jazz	IIII	(pause)

Figure 1. Chart of Morse alphabet letters, listed binarily.

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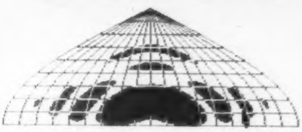

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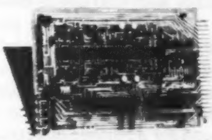

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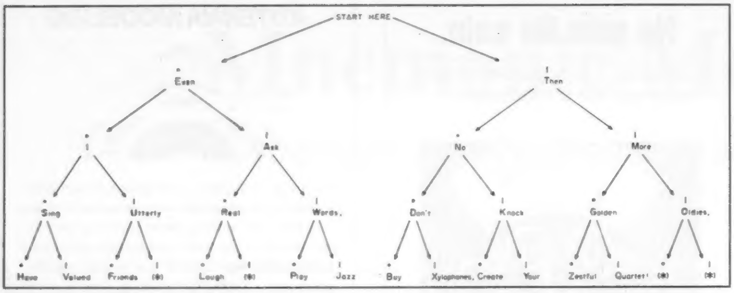


Figure 2. The Morse letter data tree, with the letters replaced by mnemonics.

Buy xylophones; create your zestful quartet (long pause).

Data Tree

One of the perennially favorite college computer science courses is something called "Data Structures." No course of this genre would be complete without a discussion of trees, usually portrayed upside-down, where the flow of data comes into one place at the top of the tree and then branches left or right according to the program logic in control at the moment. As it turns out, the portrayal of the characters of the Morse code as a tree has been around for a number of years. Most of you have probably seen this "oldie."

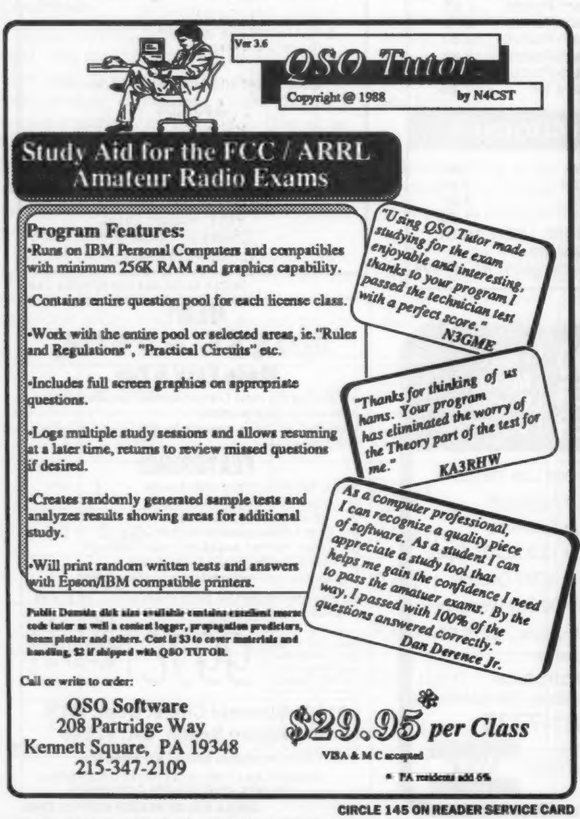
For decoding, you start at the top and move left and down if the next sound you hear is a dit or move right and down if it's a dah. Now we simply embellish this old-timer a bit by adding our mnemonic phrases (see Figure 2). The final product is this old classic tree chart made state-of-the-art by adding the mnemonic sentences to create a chart that's quicker to use than sequentially scanning a Morse code table ordinarily listed in alphabetical order.

As you can see, the chart gets crowded on the bottom row. I suggest drawing the bottom row first (you'll have 16 elements of alternating dits and dahs) and drawing upward. Don't worry about putting in the mnemonic phrases just yet, you'll do that last. Then leave a little space above that first row and lay down your alternating third row of dits and dahs (there are just eight elements now). Each element above will go between the two elements below it. The second row of four elements is then drawn before the remaining top row of just one dit and dah each is drawn to complete the data structure. Add the words "Start Here" above the top row to complete the chart.

Now start at the very top and add the words "Even Then" underneath the elements of the top row. (I suggest capitalizing every word now because it's the initial letter that you want to see quickly when decoding your message.) Then add the remaining sentences as shown in Figure 2. When you get to the bottom line, just use asterisks to represent the foreign characters because it will make that bottom row a little less congested.

The above is by no means the end of the potential for creativity that exists among the readers of *73 Amateur Radio*. Now it's your turn to see what you can do with these mnemonics to create even more effective (or whackier) and easier-to-remember memory aids. Don't forget also that I've only come up with about half an alphabet's worth of non-binary-based words and phrases. Certainly this list can be expanded.

I would like to think that I have simply picked up where G. Harold Love left off, and added my two-bits (or two dits) worth to this dialogue. I'm now looking to other readers for additional mnemonic aids to help open the doors of our hobby to those skilled in digital applications and for whom Morse code seems to be an unnecessary hurdle. 73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Grid Square Location Aid

This program aims to please.

by C. L. Houghton WB6IGP

Operation on any of our microwave bands above 2 GHz requires a means to determine compass headings to and from the station with which you want to make contact. Since most antennas in use at these frequencies are very highly directive, you need to know precisely where to point them to make contact with the distant station.

On short contacts of 10 to 15 miles, the pointing angle is not too critical. An error of 10 to 20 degrees will still provide reasonable signal strength when in the clear. When the path to cover is not line-of-sight, however, you need some pointing aid.

A common method is to lay out the pointing angle on a map with a ruler and determine the prospective compass heading to and from each location. This works out well, but requires quite a bit of time to figure out all needed compass headings. For contest time, a faster method is needed to determine distance points between contacts.

> *"The program will run on virtually any BASIC operation system."*

Location Finder

The solution to this problem is a computer program (see list in sidebar) that provides you with the compass headings from and to the desired location of contact. In addition, it determines the distance between locations in miles and kilometers. This program was adapted from multiple sources by Leon Helms WA5BNH. The program will default to your location by changing the statement in sequence 30 and 40 to your latitude (30) and longitude (40). The program can bypass the default location and you can input specific information for lati-

```
10 REM ASSEMBLED FROM MULTIPLE SOURCES BY LEON HELMS WA5BNH 9/15/86
20 PRINT:PRINT:PRINT
25 MY$="MT OTAY"
30 DA=32.5958334#
40 DG=-116.8458334#
50 GOSUB 1000
60 PRINT"Do you wish to use lat/long or grid squares? (L/G)";
70 INPUT A$:IF A$ = "l" OR A$ = "L" THEN L=1:GOTO 100
80 IF A$ = "g" OR A$ = "G" THEN L=0:GOTO 100
90 GOTO 60
100 PRINT "Do you wish to use the default coordinates for your location"
101 IF L = 1 GOTO 110
102 LA=DA:LO=DG:GOSUB 1500
105 PRINT"  ";MY$;"   ";G$;"
107 GOTO 130
110 XX=DA:GOSUB 1600
114 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
116 PRINT N$;"      X    ";:XX=DG:GOSUB 1600
118 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
122 PRINT W$;"   (y/n)";
130 INPUT A$:IF A$ = "y" OR A$ = "Y" THEN GOTO 190
135 IF A$="" THEN GOTO 190
140 IF A$ <> "n" AND A$ <> "N" THEN GOTO 100
150 PRINT:PRINT"Enter your location"
160 GOSUB 1100
170 DA = A2:DG = L2
180 GOSUB 1000
190 PRINT:PRINT"Enter other location name"
195 INPUT NA$
200 GOSUB 1100
210 K1 = L2:K2 = A2
220 PI = 3.1415926#
230 A1 = DA*PI/180
240 A2 = A2*PI/180
250 N = 1
260 L1 = DG*PI/180
270 L2 = L2*PI/180
280 Q2=TAN(A1)*COS(L2-L1)-TAN(A2)
290 Q1=COS(A1)*(Q2/SIN(L2-L1))
300 X1=270+((180/PI)*ATN(Q1))
310 L9=L2-L1
320 IF L9 <=(-PI) THEN 360
330 IF L9 <=0 THEN 370
340 IF L9 <=PI THEN 360
350 GOTO 370
360 X1=X1-180
370 IF N = 2 THEN 490
380 L3=L2
390 L4=L1
400 L2=L4
410 L1=L3
420 A3=A2
430 A4=A1
440 A2=A4
450 A1=A3
460 Y1=X1
470 N=2
480 GOTO 280
490 C1=ABS(L9)
500 IF C1>PI THEN 520
510 GOTO 540
520 C1=2*PI-C1
530 REM arc cosine must be converted to equivilent form in basic
540 Z2=SIN(A1)*SIN(A2)
550 Z3=COS(A1)*COS(A2)*COS(C1)
560 Z4=Z2+Z3
570 Z1=-ATN(Z4/SQR(-Z4*Z4+1))+(PI/2)
580 Z1=Z1*180/PI
590 A=69.05*Z1
600 B=60*Z1
```

The BASIC listing of the grid square location program.

```
610 E=111.12*Z1
630 C=Y1+180
640 IF C>360 THEN C=Y1-180
650 Y1=INT(Y1*100+.5)/100
660 X1=INT(X1*100+.5)/100
670 A=INT(A*100+.5)/100
680 B=INT(B*100+.5)/100
690 IF K2 > 0 THEN S$ = "N" ELSE S$ = "S"
700 IF K1 > 0 THEN E$ = "E" ELSE E$ = "W"
705 GOSUB 1000
710 XX=DA:GOSUB 1600
720 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
730 PRINT N$;"  ";:XX=DG:GOSUB 1600
740 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
750 PRINT W$;
760 PRINT TAB(39);"to";
770 XX=K2:GOSUB 1600
780 PRINT TAB(43);
790 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
800 PRINT S$;" ";
810 XX=K1:GOSUB 1600
820 PRINT XD;CHR$(248);XM;"'";XN;CHR$(34);" ";
830 PRINT W$
840 LA=DA:LO=DG:GOSUB 1500
850 PRINT"  ";MY$;"     ";G$;TAB(39);"to   ";NA$;TAB(60);
860 LA=K2:LO=K1:GOSUB 1500
870 PRINT G$
880 PRINT
890 PRINT"Local true heading  ="Y1;"deg";TAB(40);
900 E=INT(E*100+.5)/100
910 PRINT"Distant true heading ="X1;"deg"
920 PRINT"Statute miles        =";A
930 PRINT"Nautical miles       =";B
940 PRINT"Kilometers           =";E
960 GOTO 190
1000 IF DA > 0 THEN N$ = "N" ELSE N$ = "S"
1010 IF DG > 0 THEN W$ = "E" ELSE W$ = "W"
1020 RETURN
1100 IF L = 0 THEN GOTO 1300 ELSE GOTO 1120
1110 PRINT"Please specify 'N' or 'S'. "
1120 PRINT"Enter latitude: Degrees,minutes,seconds,(N or S)"
1130 INPUT W1,W2,W3,I$
1140 IF I$ <> "n" AND I$ <> "s" AND I$ <> "N" AND I$ <> "S" THEN GOTO 1110
1150 IF I$ = "s" OR I$ = "S" THEN W1 = -W1:W2 = - W2:W3 = - W3
1160 A2 = W1 + (W2/60) + (W3/3600)
1170 GOTO 1190
1180 PRINT"Please specify 'E' or 'W'. "
1190 PRINT"Enter longitude: Degrees,minutes,seconds,(E or W)"
1200 INPUT R1,R2,R3,D$
1210 IF D$ <> "e" AND D$ <> "w" AND D$ <> "E" AND D$ <> "W" THEN GOTO 1180
1220 IF D$ = "w" OR D$ = "W" THEN R1 = -R1:R2 = - R2:R3 = - R3
1230 L2 = R1 + (R2/60) + (R3/3600)
1240 RETURN
1300 INPUT "Grid square (ex. DM13ET) ";C$
1310 IF LEN(C$)=4 THEN C$=C$+"MM"
1320 ER=0:IF LEN(C$)<>6 THEN GOTO 1300
1330 FOR K=1 TO 6:A(K)=ASC(MID$(C$,K,1)):NEXT
1340 IF A(1)>90 THEN A(1)=A(1)-32
1350 IF A(2)>90 THEN A(2)=A(2)-32
1360 IF A(5)>90 THEN A(5)=A(5)-32
1370 IF A(6)>90 THEN A(6)=A(6)-32
1380 L2=-(180-(A(1)-65)*20-(A(3)-48)*2-(A(5)-64.5)/12)
1390 A2=-90+(A(2)-65)*10+(A(4)-48)+(A(6)-64.6)/24
1400 RETURN
1500 IF INT(LA/10)=LA/10 THEN GOTO 1700
1503 IF INT(LO/20)=LO/20 THEN GOTO 1700
1505 B(2)=INT((LA+90)/10)
1510 B(4)=INT((LA+90)-(B(2)*10))
1520 B(6)=INT((LA-INT(LA))*24)+65
1530 B(1)=INT((180+LO)/20)
1540 B(3)=INT(((LO+180)-(B(1)*20))/2)
1550 B(5)=INT((LO-INT(LO))*12)+65
1560 IF INT(INT(ABS(LO))/2) = INT(ABS(LO))/2 THEN B(5)=B(5)+12
1570 G$=CHR$(B(1)+65)+CHR$(B(2)+65)+CHR$(B(3)+48)+CHR$(B(4)+48)+CHR$(B(5))
1580 G$=G$+CHR$(B(6))
1590 RETURN
1600 XA=ABS(XX)
1610 XD=INT(XA)
1620 XM=INT((XA-XD)*60)
1630 XN=INT((XA-(XD+(XM/60)))*3600)
1640 RETURN
1700 N=0:L=0:O=0
1705 IF INT(LA/10) = LA/10 THEN N = 1:L = 1
1710 IF INT(LO/20) = LO/20 THEN O = 1:L = L+1
1720 IF N=1 THEN LA=LA+1/3600 :REM add one second
1730 IF O=1 THEN LO=LO+1/3600 :REM add one second
1740 GOSUB 1505
1750 CC=POS(C) :REM get the cursor position
1760 PRINT G$       :REM print on possible answer
1770 PRINT TAB(CC); :REM TAB BACK TO WHERE THE CURSOR WAS
1775 IF N=1 THEN LA=LA-2/3600
1780 IF L = 1 GOTO 1820
1790 GOSUB 1505
1800 PRINT G$       :REM print on possible answer
1810 PRINT TAB(CC); :REM TAB BACK TO WHERE THE CURSOR WAS
1820 IF O=1 THEN LO=LO-2/3600
1825 IF L = 1 GOTO 1505
1830 GOSUB 1505
1840 CC=POS(C) :REM get the cursor position
1850 PRINT G$       :REM print on possible answer
1860 PRINT TAB(CC); :REM TAB BACK TO WHERE THE CURSOR WAS
1870 LA=LA+2/3600
1880 GOTO 1505
```

The BASIC listing of the grid square location program (continued).

tude/longitude or grid squares, as it is all menu driven.

I used the program to assist a contact during the last 10 GHz microwave contest from Mt. Helix, in San Diego proper, to Heaps Peak, located near Lake Arrowhead in the mountains above San Bernardino. Entering the program, I selected the grid square option and omitted the default location and replaced it with my location at Mt. Helix—grid square DM12LT. The other station, contacted on the co-ordinating frequency on 2, stated he was located at DM14KF, Heaps Peak. The computer (Tandy 100) took 5 seconds to produce the following output:

```
DM12LT 32 X 48.30 N, 117 X 2.29 W TO
DM14KF 34 X 13.29 S, 117 X 7.29 W
LOCAL TRUE HEADING 357.22, DISTANT TRUE HEADING 177.17 DEGREE
STATUTE MILES 97.9, KILOMETERS
157.55
```

You can use this example to check out your system, once loaded, and verify proper operation on your computer. One note: Distance is computed from the center of the grid square.

"(The program) was a much welcome aid during microwave contest operations."

Versatile

The program will run on virtually any BASIC operation system. At present, it is used on a Tandy 100 laptop, a Kaypro CPM 2x, and some MS-DOS machines. For use on the Tandy 100 laptop, line 620 is deleted and a new line 620 is inserted as follows: (620 CLS).

This program allowed me to determine exact compass headings. It was a much welcome aid to help me aim my antenna towards the locations of unexpected stations that crop up during contest operation.

Normally I would have made available a disk or cassette, but due to the variety of computers being used—all taking different formats for input—I cannot reproduce a copy in your format. However, I will gladly send the program via modem. This seems to be the best method at present. WA5BNH has made the program fit into a Tandy PC-4 pocket computer with some re-assembling. Leon will make the PC-4 program available with or without the PC-4. Contact Leon Helms 10153, Ambassador Dr., San Diego CA 92126, for details.

Those microwave enthusiasts interested in obtaining more information about the myriad of 1 GHz and above operations going on in California, and around the world, may contact the author at the San Diego Microwave Group, 6345 Badgor Lake, San Diego CA 92119. Chuck WB6IGP also now writes a monthly column for VHF and above activities "Above and Beyond."

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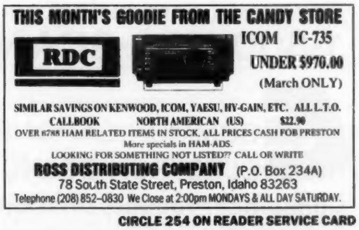

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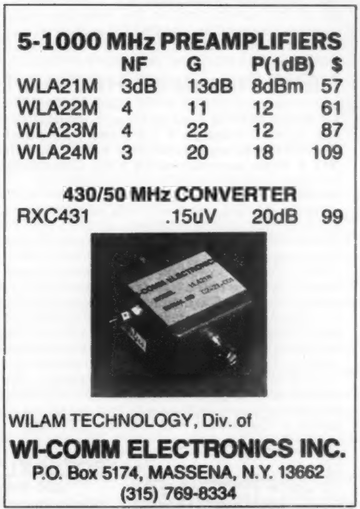

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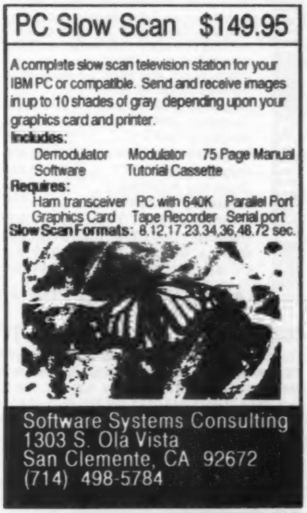

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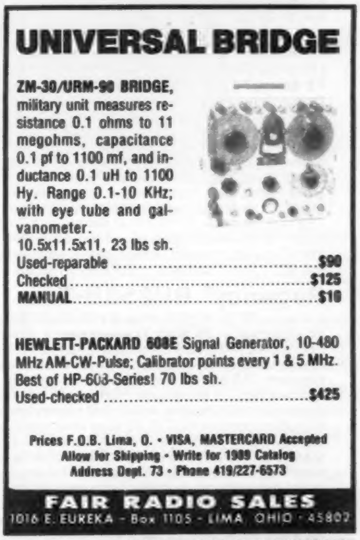

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Uniden PRO500D-T	**$34.95**

COUPON COUPON

★★★★VALUABLE COUPON ★★★★

NEW! Bearcat® 760XLT-T

List price $499.95/**CE price $244.95/SPECIAL**

12-Band, 100 Channel • Crystalless • AC/DC

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.
Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-T** is a similar version without the 800 MHz. band for only $194.95. CTCSS squelch option now available.

SALE! Regency® TS2-T

List price $499.95/**CE price $269.95/SPECIAL**

12-Band, 75 Channel • Crystalless • AC/DC

Frequency range: 29-54, 118-175, 406-512, 806-950 MHz.

The *Regency* TS2 scanner lets you monitor Military, Space Satellites, Government, Railroad, Justice Department, State Department, Fish & Game, Immigration, Marine, Police and Fire Departments, Aeronautical AM band, Paramedics, Amateur Radio, plus thousands of other radio frequencies most scanners can't pick up. The *Regency* TS2 features new 40 channel per second *Turbo Scan™* so you wont miss any of the action. Model **TS1-T** is a 35 channel version of this radio without the 800 MHz. band and costs only $199.95.

Regency® RH256B-T

List price $799.95/**CE price $299.95/SPECIAL**

16 Channel • 25 Watt Transceiver • Priority

The *Regency* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-T** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-T** is also available and covers 450-482 MHz. but the cost is $454.95.

★★★ Uniden CB Radios ★★★

The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

PRO310E-T *Uniden* 40 Ch. Portable/Mobile CB	$83.95
PRO330E-T *Uniden* 40 Ch. Remote mount CB	$104.95
PRO500D-T *Uniden* 40 Channel CB Mobile	$38.95
KARATE-T *Uniden* 40 channel rescue radio	$53.95
GRANT-T *Uniden* 40 channel SSB CB mobile	$166.95
MADISON-T *Uniden* 40 channel SSB CB base	$244.95
PC122-T *Uniden* 40 channel SSB CB mobile	$119.95
PRO510XL-T *Uniden* 40 channel CB Mobile	$38.95
PRO520XL-T *Uniden* 40 channel CB Mobile	$56.95
PRO530XL-T *Uniden* 40 channel CB Mobile	$79.95
PRO540E-T *Uniden* 40 channel CB Mobile	$97.95
PRO640E-T *Uniden* 40 channel SSB CB Mobile	$137.95
PRO710E-T *Uniden* 40 channel CB Base	$119.95
PRO810E-T *Uniden* 40 channel SSB CB Base	$174.95

★★★Uniden Radar Detectors★★★

Buy the finest *Uniden* radar detectors from CEI today.

TALKER-T *Uniden* talking radar detector	$184.95
RD7-T *Uniden* visor mount radar detector	$99.95
RD9-T *Uniden* "Passport" size radar detector	$114.95
RD9XL-T *Uniden* "micro" size radar detector	$144.95
RD25-T *Uniden* visor mount radar detector	$54.95
RD500-T Uniden visor mount radar detector	$74.95

Bearcat® 200XLT-T

List price $509.95/**CE price $254.95/SPECIAL**

12-Band, 200 Channel • 800 MHz. Handheld
Search • Limit • Hold • Priority • Lockout

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.
Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T

List price $549.95/**CE price $259.95/SPECIAL**

12-Band, 40 Channel • No-crystal scanner
Priority control • Search/Scan • AC/DC

Bands: 29-54, 118-174, 406-512, 806-912 MHz.

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/**CE price $94.95/SPECIAL**

10-Band, 16 Channel • No-crystal scanner
Priority control • Weather search • AC/DC

Bands: 29-54, 136-174, 406-512 MHz.

The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

Regency® Informant™ Scanners

Frequency coverage: 35-54, 136-174, 406-512 MHz.

The new *Regency* Informant scanners cover virtually all the standard police, fire, emergency and weather frequencies. The **INF1-T** is ideal for truckers and is only $129.95. For base station use, the **INF5-T** is $84.95. Order your scanner today.

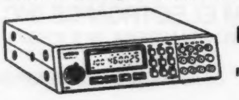
NEW! President® HR2510-T

List price $499.95/**CE price $239.95/SPECIAL**

10 Meter Mobile Transceiver • Digital VFO
Full Band Coverage • All-Mode Operation
Backlit liquid crystal display • Auto Squelch
RIT • Preprogrammed 10 KHz. Channels

Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.

The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.



BC760XLT
800 MHz.
mobile scanner
SPECIAL!

★★★ Facsimile Machines & Phones ★★★

If you need an excellent facsimile machine, CEI has the full featured Faxtel 3300 fax by Pactel at a special price.

FAX3300-T *Pactel* Fax machine with phone	$1,099.95
XE750-T *Uniden* Cordless Phone with speaker	$99.95

★★★ Extended Service Contract ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

OTHER RADIOS AND ACCESSORIES

BC55XLT-T *Bearcat* 10 channel scanner	$114.95
BC70XLT-T *Bearcat* 20 channel scanner	$159.95
BC175XL-T *Bearcat* 16 channel scanner	$156.95
R1090-T *Regency* 45 channel scanner	$119.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver	$114.95
BPS5-T *Regency* 16 amp reg. power supply	$179.95
MA549-T Drop-in charger for HX1200 & HX1500	$59.95
MA518-T Wall charger for HX1500 scanner	$14.95
MA553-T Carrying case for HX1500 scanner	$14.95
MA917-T Ni-Cad battery pack for HX1000/1200	$39.95
BP205-T Ni-Cad batt. pack for BC200/BC100XLT	$49.95
B8-T 1.2 V AA Ni-Cad batteries (set of eight)	$17.95
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FBW-T Frequency Directory for Western U.S.A.	$14.95
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SRF-T Survival Radio Frequency Directory	$14.95
TSG-T "Top Secret" Registry of U.S. Govt. Freq.	$14.95
TTC-T Tune in on telephone calls	$14.95
CBH-T Big CB Handbook/AM/FM/Freeband	$14.95
TIC-T Techniques for Intercepting Comm.	$14.95
RRF-T Railroad frequency directory	$14.95
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MFF-T Midwest Federal Frequency directory	$14.95
A60-T Magnet mount mobile scanner antenna	$35.95
A70-T Base station scanner antenna	$35.95
A500-T 10 & 11 Meter – 500 Watt antenna	$38.95
A1300-T 25 MHz.–1.3 GHz Discone antenna	$109.95
USAMM-T Mag mount VHF ant. w/ 12′ cable	$39.95
USAK-T ¾" hole mount VHF ant. w/ 17′ cable	$35.95
USAK450-T ¾" hole mount UHF ant. w/ 17′ cable	$35.95

Add $4.00 shipping for all *accessories* ordered at the same time.
Add $9.00 shipping per radio and $4.00 per antenna.

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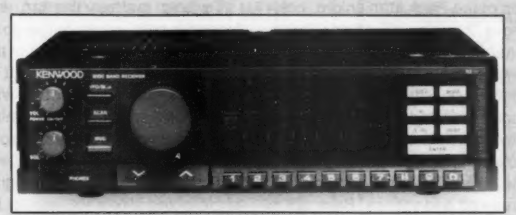


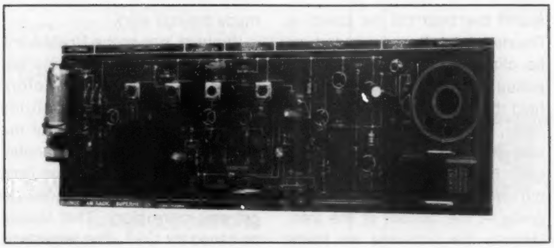
PRODUCT OF THE MONTH

KENWOOD USA CORPORATION

RZ-1

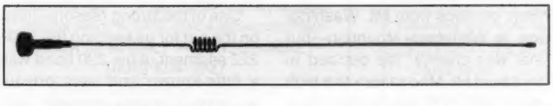
Kenwood's RZ-1 wideband scanning receiver covers 500 kHz to 905 MHz in AM, and narrow or wideband FM. The automatic mode selection function makes tuning easy. This new receiver features one hundred memory channels with message and band marker, direct keyboard or VFO frequency entry, and scanning functions, such as memory channel and band scan with four types of scan stop.

The RZ-1 is a 12 volt DC operated, compact unit with built-in speaker, front-mounted phone jack, switchable AGC, squelch for narrow FM, illuminated keys, and a "beeper" to confirm keyboard operation. Suggested retail price is $600. *Kenwood USA Corporation, 2201 E. Dominguez Street, Long Beach CA 90810. Phone (213) 639-4200. FAX: (213) 604-4487.*



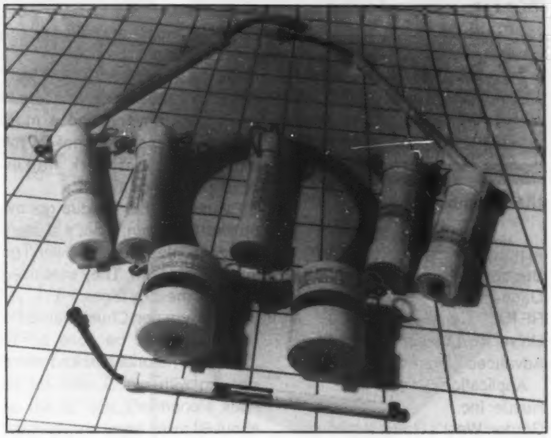
ELENCO ELECTRONICS, INC.

The Elenco Superhet 550 AM Radio Kit is a superheterodyne receiver of the standard AM frequencies. It uses seven transistors. By placing the parts over their corresponding symbols in the schematic drawing on the surface of the PC board, learning is enhanced during assembly. Included is an excellent assembly, lesson, and theory manual. Good project for classroom studies. Price, $20. *Elenco Electronics, Inc., 150 West Carpenter Avenue, Wheeling IL 60090. 312-541-3800. FAX: 312-520-0085.* Circle Reader Service number 202.



VALOR ENTERPRISES, INC.

Valor Enterprises' Model PUC 450 UHF collinear gain antenna features 100 Watt power rated Motorola base and silver-plated spring loaded contact. The unit has a 450–470 MHz frequency range. Price is $40. *Valor Enterprises, Inc., 185 West Hamilton Street, West Milton OH 45383. (513) 698-4194. Watts: 800-543-2197; FAX: (513) 698-7273; Telex: 724-389, Attn: Valor.* Circle Reader Service number 206.

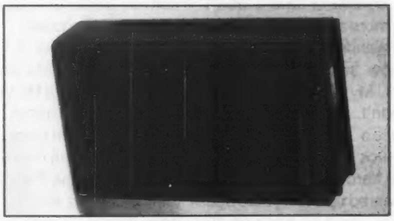


THE RADIO WORKS

The Radio Works now has a comprehensive balun line of ten different models. Three models have 4:1 ratios. The B4-1.5k ohm ferrite balun is general purpose, saturation resistant, and covers 80–10 meters. Five models have 1:1 ratios. These are all "current-type(c)" baluns. The "C-series" baluns are designed for retrofit applications in wire antennas and beams from 160 through 10 meters. The C75-2k and the C75-4k are 75 ohm models; they are the only baluns made specifically for the quarter-wave matching sections commonly found in Delta-Loop and Cubical Quad antenna designs.

The B1-2k and B1-4k models fill out the 50 ohm high power 1:1 line. They are suitable for wire antennas of all types. B1-2k and B1-4k are "current-type." The RemoteBalun(c) finally solves the problem of getting open-wire or ladder-line into the ham shack, and the Line Isolator(c) is useful for preventing RF current from causing feedback problems.

All Radio Works baluns feature rugged cases. If eye-bolts are used, they are stainless steel. All internal connections are soldered, and leads from the balun's windings are brought outside the case for direct connection to the antenna wire. Each balun is completely potted. Prices begin at $15.95. *The Radio Works, Box 6159, Portsmouth VA 23703. 804-484-0140.* Circle Reader Service number 204.



PERIPHEX, INC.

Periphex's super performance battery packs for the Yaesu FT-727R, 109RH, 209R/RH, 709R, 103R, 203R, and 703R include overcharge, over-temperature, and short-circuit protection, and a 1-year warranty.

The FNB-4SH, 12 volts 1000 mAh is double the capacity of the original pack, still with the full 5 Watt output. It is compatible with the Yaesu NC-15 base charger. Price, $71.

The FNB-4SL, 12 volts 750 mAh is 150% the capacity of the original pack, still with the full 5 Watt output. It is compatible with the Yaesu NC-15 base charger, NC-18B and PA-3 trickle charger. Price, $65.

The FNB-3S, 9.6 volts 1200 mAh is almost triple the capacity of the original pack. It is designed as a long life battery pack with the 3.5 Watt output. It is compatible with all three battery chargers listed above. Price, $60.

Periphex, Inc., 149 Palmer Road, Southbury CT 06488. (800) 634-8132. In CT: (203) 264-3985. Circle Reader Service number 208.

Never Say Die

Continued from page 8

Please note the groups that are supporting this effort, since this shows they have a serious interest in supporting our hobby, rather than just viewing it as a business.

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Poor, Dumb Wayne

A recent nationwide telephone/repeater net discussed the 220 mess. I was asked to comment on the problem and suggested the use of 10 GHz to solve the allocation problems for repeaters on 450 and 220. This was dismissed as a dumb suggestion over the net, with the comment that I don't know any more about 10 GHz than the Commission. Well, dumb old Wayne now and then does his homework. My pontificating pettifogger hadn't.

Egged on by my long-time friend Chuck Martin KO1I, who did all the hard work building the rigs, we geared up a few years ago to see what could be done on 10 GHz. One of the reasons I moved to New Hampshire twenty-five years ago was the proximity of Mt. Monadnock, a 3165-footer, and Pack Monadnock, that runs 2310 feet high. Nice little rock piles to have near a known VHF/UHF fanatic.

Indeed, back in 1963 I put together quite a station on Mt. Monadnock, running 336 elements, and an AM kilowatt on 2 meters (with 2 kW modulation)—a 16-element collinear and a kW on 6 meters, and so on. I wanted to be heard, and I was! A ham in Norfolk, some 550 miles down the coast, said my signal never went below S6, no matter how bad the propagation got.

We did a good deal of 220, 432, and even 1296 work up there. I don't think anyone had a more powerful 2 meter signal in the country. I could work walkie-talkies 300 miles away!

Eventually, the League got me off the mountain. That's a story I've gone into before, so I won't go into it again here. They sure used to pull some dirty tricks.

Anyway, when Chuck wanted to see what could be done on 10 GHz I was naturally excited about working with him. I went up on Pack Monadnock and he set up about 60 miles away on a hill near Boston. Even with a compass and two meter coordination it took almost a half hour before we finally clicked. When we were both pointed in exactly the same direction and on the same frequency, it was fantastic. The sound quality was incredible—and it was duplex! We could talk and listen at the same time. What a way to go. I hadn't been able to do that on amateur radio since 1938 on 160m when we'd assemble nets that could work duplex like that.

Okay, our 10 GHz gear worked. Now, how about trying it from Mt. Agamenicus in southern Maine? So Chuck drove over there one evening after work and we fished around for fifteen or twenty minutes before we made it. Then wham! Solid signals! And we were both running about 1/10 watt with no external antenna—just a little horn on the small transceiver box a few inches square.

Hmmm, wonder if it will work over a hundred-mile path? Chuck drove to the top of Mt. Washington one Saturday, about 103 miles away. He parked there, aiming his horn antenna out his car window. I sat on top of the Pack in my van, aiming my rig out my front window. It was so cold neither of us were interested in going outside. For some reason I never seem to do ham experimenting when it's warm or comfortable.

The aiming of the rigs was so critical we thought we weren't going to be able to make it. I had a map and a compass and was aiming at where I thought Mt. Washington ought to be. But was there a mountain in between that would stop us? It was difficult to be sure. We kept at it and suddenly we had a full quieting signal. We'd done it!

Vermont was next—Mt. Ascutney, over near White River Junction—well over 50 miles. We tried this the next weekend—it was getting easy by now. We clicked in less than ten minutes. But it was getting colder and I was freezing my galuccies standing up there on the stairway of the fire tower on top of the Pack at midnight, holding a 2 meter HT in one hand, flashlight under my chin and swinging the 10 GHz rig back and forth while calling Chuck as he tuned the band. Both of us had to have the little buggers aimed exactly right at the same time and on the same frequency. A few degrees off and silence. Back again and it was full dead quieting.

Next was Connecticut, a snap. Chuck found a good hill in northern Connecticut and we had state number five bagged. Could we do Rhode Island? It was not only much further away, it's a very flat state. The hills there are hundreds of feet, not thousands. The highest point in the whole state is 812 feet—Jerimoth Hill.

Just to give us an edge Chuck armed himself with a 3-foot dish to get some extra gain. With the help of Tim Daniel N8RK I lugged a similar dish to the top of Mt. Monadnock, giving me an extra thousand feet of elevation and a head start toward a heart attack—that's tough climbing. Chuck with the help of Eric Williams WA1HON, found the best hill he could in Rhode Island. It was wooded, so he climbed the tallest tree and aimed the dish with one hand, held the rig and tuned it with the other, held the branches with his legs and tried not to be blown out of the tree as the wind grabbed the big dish. Eric kept the 2 meter link going at the bottom of the tree. Despite the problems we made the connection—solid again. If both of us hadn't been suffering from the wind and cold, we might have tried it with just the little horns. I'm sure it would have worked, even over that poor path.

Now what? We'd managed all six New England states. New York was the obvious next step. Our topographical maps didn't show any clear path between anywhere in New Hampshire and New York. Well, perhaps from Mt. Washington to Whiteface Mountain—but that was chancy. We decided to try it from Mt. Monadnock to a high point just over the border from Massachusetts in New York. It meant pushing the signal over a mountain to do it, but it was worth a try.

So Chuck and Eric chugged over to New York and got set up. Tim and I climbed that miserable mountain again, chancing cardiac arrest. I panted and sweated my way up. Sherry came along too, but she couldn't quite make it to the top—too tough a climb for a grandmother of 11 kids.

To help matters the top was fogged in solid, so all I had to go by was a compass. We set up the 3-foot dish on a tripod, aimed it by the map and coordinated with Chuck on 2m. We started tuning and calling. Bingo! Again a solid S-9+ signal. We couldn't believe it. There was no way for the signal to be going direct—it had to be bending over Mt. Greylock. Seven states on 10 GHz! Well, seven states for me—and one state for Chuck.

We could have made it to Canada from Mt. Washington, but we weren't sure the "glory" was worth the aggravation. And besides, it was by now so late in the fall that getting up on Mt. Washington would have to wait for spring anyway.

How about 24 GHz? This was supposed to be much more difficult, with weather affecting it more, but so little ham experimenting had been done that no one had data on it. So Chuck borrowed a couple of 24 GHz rigs from Microwave Associates, the outfit that made the diodes that made the rigs work.

We tried 'em on the NH/MA link and had problems. The rigs just weren't working right. Before Chuck could fix 'em politics reared its ugly head. One of the hams at M/A, a League fanatic, put on pressure to keep us from using the rigs. He didn't want *73* to get any more glory. That should be saved for *QST*. The result was that Chuck chucked the project in disgust and, with no driving force to make it happen, 24 GHz dropped dead.

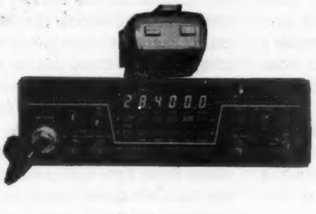
So now, those who are convinced 10 GHz will never be able to replace 220 and 450 MHz links, let's come up to date about twenty years. Are you living in the past and damaging ham credibility with the FCC by not knowing what you're talking about?

One of the strong reasons given on the net for us keeping the 220–222 segment of the 220 band was a little-known and very private western (Condor) repeater network. I used the parent of this setup almost twenty years ago when I was able to talk using a 2 meter HT from a street corner in Las Vegas and talk with hams in

Continued on page 62

10 METER DX IS HOT!

AND YOU CAN WORK IT WITH THE NEW RANGER AR 3500



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SPECIFICATIONS

Frequency: Range 28.0000-29.9999 MHz. in 100 Hz steps.
Sens.: SSB/CW 0.3 μV, FM 0.5 μV.
Power: SSB 25W PEP, 30W, CW, 8W FM
Input: 12.5 V, 6A DC
Dimensions: 2.4"×7.7"×11" Wt: 3 Lbs.

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RS7A Pwr Supply for 30W Ranger	49.95
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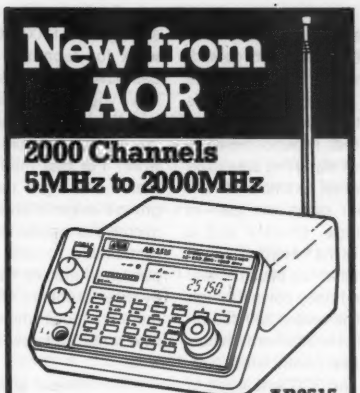

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Never Say Die

Continued from page 60

San Diego, San Francisco and Phoenix in a round table. This was the Gronk Network—a monumental pioneering effort that was kept far too secret.

Today the same linking system seems to be going, but with no improvements of which I'm aware. This means that in time of a serious emergency—and providing none of the mountain-top repeater links are knocked off the air or deprived of power, they'd be able to handle maybe twenty messages an hour. Great.

Well, we've had some emergencies. Have you ever read of the Condor Net providing public service? Please advise.

We're just a tad behind in technology when you consider that Ma Bell is now sending 117K baud over a normal twisted pair. That's about 100 thousand words per minute. With some simple encoding we could up that to about 350,000 words per minute that we could push through our repeaters. With that sort of capacity we might be of some value in a serious emergency. At twenty messages per hour, let's forget it and go back to smoke signals.

Our "Full" Bands

We suffer again from credibility when we claim that the 450 band is "full" in some areas of the country. Now, this may really be true, but no one has bothered to document the situation in print that I recall, so therefore the concept is suspect. Publish or perish again.

I travel around the country a good deal, lugging an HT with me as I go. In every city I visit I make it a point to say hello on every repeater I can access. I manage to get a reply in perhaps one out of ten—at best. When I'm up in a private plane I check all channels for activity. Up there, where I can hear for a hundred miles or so and there are several repeaters on every channel, it's busier. But I sometimes get the idea that the trend is toward one ham, one repeater.

If the Southern California repeater and remote base ops actually are using every 450 channel efficiently, it would be well worth the effort to do some research and write an article. I'll publish it and make sure the FCC sees it. But, lacking such data, it's not difficult to imagine that there is more politics in play than cooperation.

I've visited the area often over the last 40 years—even considered moving out there one time because I had so many friends there and I enjoyed the spirit of adventure that I found there. In recent years I found this area to be by far the worst example of how bad amateur radio can get—in bad language, threats and a breakdown of the fraternal spirit of cooperation that has been the real power of our hobby down through the years. The recent 220 coordination conflict in Southern California may have contributed substantially to the FCC's decision to take away 40% of the band.

It does look as if the FCC were being moved by political (lobby) pressures more than reason. Fighting city hall through the courts, as the ARRL has threatened to do, might win. Well, there goes a big lump of that rainy day money they've been packing away. They sure do awfully well for a non-profit outfit, with millions salted away—have to hand it to 'em.

Whether we hams have a legitimate need for the 220–222 band is arguable. If one goes by what data is available—what's been published—it looks as if we're hearing hot air. And ditto for the claims that 450 is packed solid.

If the FCC has any idea of turning over this band for compandered sideband (CSB) then I believe they're being given a crock. That's a mode of communications that hasn't proven practical—and that despite strong League support. *QST* published articles on it—quickly put it in the Handbook—and gave it their support. Engineers looked at the system and gave it the horse laugh.

I hear about 56K packet experimenting—about 9600 baud packet being used more and more—yet how many articles am I getting about this work? Well, the FCC gets their idea of amateur radio from looking at the ham magazines. What do they see? Not much.

Several clubs have been doing a wonderful job of attracting and licensing youngsters. How many have you seen written up in the ham magazines? Not many. So how's the FCC to know? And, without some PR on the subject, how can we expect other clubs to get the idea and start to follow suit? The general impression is that it's impossible—it can't be done. Well, it's being done, but those doing it are silent.

I heard hams on the 220 net saying that 1200 MHz wouldn't work for repeater and remote base links. How would they know? Have you ever seen an article in a ham magazine on the subject saying the band would or wouldn't work? For that matter, now and then I see signs that there are groups experimenting with our microwave bands—some setting remarkable records. How many published articles have you seen by these pioneers? It seems as if there are those who do and those who write, but few who do and write.

If the repeater groups insist on playing the game close to the vest, they're going to lose the game. Whether we keep our bands or not is a matter of politics, not engineering, so we've got to play the politics game. This means a lot more than an indignant letter to your congressman. It means using the media for PR. It means articles in *73*—which I'll see that the FCC and congressmen get. It means PR over your local radio and TV stations. It means not only doing service in emergencies, it means making sure the networks and press associations know about it.

Field Day is a natural. Or it would be if you started your planning for it at least four months ahead. You not only need to plan for power, antennas and towers, rigs, tents, food and accommodations, you need to plan your photos and write-ups for the ham magazines and local press—plus sound bites for local TV. They may even be able to get it onto the network for you, if you've planned well.

I've done a video on how to do PR—sells for $99 and has gotten great praise from many buyers. One key to getting into the media is to do as much of the editor's work as possible. Editors are busy and, like the rest of us, will let others do as much as possible of our work. The easier you make it, the more you'll get published. Anyone with a business of any kind would do well to check out my video. It should, with little added expense, help you to generate at least an extra million dollars in revenue per year—just by the sneaky use of PR, which I describe in detail.

I believe that if the FCC saw any convincing sign that amateur radio could get into a growth pattern—could attract youngsters and might eventually have some use for our frequencies for other than the amusement of a dwindling group of old men, we wouldn't have any further serious problems with them.

So, instead of bitching about our loss, I suggest we learn from it and get cracking on rebuilding our hobby. We need new, young hams—by the tens and then the hundreds of thousands. We need to take our work with packet and develop it into a high speed practical communications system that can be used to handle the traffic load a serious emergency will bring. Our 300 baud packet is a crawl. The 1200 baud is better—a wobbly walk. The few 9600 baud circuits are more like it. The rumored 56K baud experimenting needs more light and promotion. We haven't done much to be worth our salt in 25 years, so it's about time we tried to at least catch up with Ma Bell and the commercial world. Then we can move ahead of 'em and have something to brag about that's real.

In dealing with the FCC, please remember that the commissioners are political appointees, not engineers. Thus they tend to respond to political more than engineering pressures. Remember too, that ham problems such as our recent 220 California coordination mess are a royal pain, so the natural tendency for the Commissioners is not to bend over backwards to be nice to us. We're often a major FCC aggravation, but with few redeeming benefits that are immediately apparent. And when, from their viewpoint, they try to help us, we respond by viciously biting the hand that's feeding us.

If we would think first in terms of solving our problems instead of immediately trying to dump them on the FCC, we might not find them considering ham frequencies when the commercial firm lobbyists start pushing.

I hope all that makes sense—now let's get started with exploring 900 MHz and writing articles on it. Let's start easing the pressures on 450 with 1200 MHz and up links. While not every 450 link may work on 10 GHz, my experience tells me that most of 'em will—and with far better service than at present. We've got 500 MHz up there to use and, as far as I know, there's not one single ham actively using the band. What a waste!

So we have repeater groups at war, complete with lawsuits over 450, when the equipment for 10 GHz is cheaper and more dependable. Weird.

Number 17 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, MD, WA3AJR
6 Jenny Lane
Baltimore MD 21208

Here in Maryland, many snowy and icy days will come before the end of March, and yet, at the same time, we can see the spring buds forming on the trees. It is still winter, and yet it's spring, too.

In our hobby, the simile is not lost. The amateur world in general, and the RTTY community in particular, has quite a variety of snowy, icy, warm, and sunny folk. As we look toward completing the twelfth year of RTTY Loop, I find myself wondering who you, the readers of RTTY Loop, are.

Therefore, I hereby introduce the first duodecannual RTTY Loop survey. This is a bit unlike any survey you've ever seen, but then again, this column is probably a bit unlike any other as well. So, feel free to photocopy and scribble in the margins, write out the answers longhand on a yellow pad, or put them in a text file on an MS-DOS, CoCo or CoCo/OS9 disk and send them to me at the above address. Adventurous souls can even E-mail their survey via CompuServe or Delphi; see the end of the column for details.

So, if you are ready, here we go. Just follow the numbers and directions given for each question. If this all works out, we will be together at the end.

RTTY Loop Survey

1. Are you currently on RTTY? If the answer is YES, go to question 2; if the answer is NO, go to question 8.

2. Are you using a mechanical teleprinter? If the answer is YES, go to question 3; if the answer is NO, go to question 4..

3. What model of teleprinter are you using? Proceed to question 4.

4. Are you using a computer on RTTY? If the answer is YES, go to question 5. If the answer is NO and you are NOT using a mechanical teleprinter, go to question 7; the answer is NO and you are using a mechanical teleprinter, go to question 10.

5. What kind of computer are you using? Proceed to question 6.

6. What computer software are you using? Go to question 10.

7. Well, then, what are you using on RTTY? Go to question 10.

8. Have you ever been on RTTY? If the answer is YES, answer the following questions as applicable to your past experience and go to question 2. If the answer is NO, proceed to question 9.

9. Are you planning to get onto RTTY? If the answer is YES, answer the following questions as applicable to what you plan to do, and go to question 2. If the answer is NO, go to question 16.

> ***". . . any communications software, such as you would use with a telephone modem, is fine to set up a data controller/computer for RTTY operation."***

10. Do you use a separate terminal unit? If the answer is YES, go to question 12. If the answer is NO, proceed to question 11.

11. Then what are you using to decode RTTY? Answer and then go to question 13.

12. Which terminal unit are you using? After answering, proceed to question 13.

13. What bands do you like to operate on? After answering, proceed to question 14.

14. Do you operate on AMTOR? After answering, proceed to question 15.

15. Do you operate on packet? After answering, proceed to question 16.

16. What topics would you like to see covered in future editions of RTTY Loop?

17. Are there any topics you think we devote too much time to?

18. Do you have or use a computer for other than RTTY? If the answer is NO, go to question 22. If the answer is YES, proceed with question 19.

19. What kind of computer do you have?

20. Are you active on any computer bulletin boards, national or local? If the answer is YES, go to question 21.

21. Which, if any, large scale boards are you on?

22. This is the end of the survey. Please feel free to add any comments you would like.

If all goes well, I should be able to put together some sort of analysis of this survey by the June or July issue, given both the delay many of you will generate before responding, and the lead time of the magazine. Please try to respond, each and every one of you. It is through reader feedback that I gauge the direction of future columns.

TRS-80 Model I

Here's one of those letters that I only hope some of you readers, somewhere, can lend a hand with. Dan Johnson KG4MD at the Naval Hospital in Norfolk, Virginia, wants to get his TRS-80 Model I computer set up to operate on RTTY. He has been having troubles with the interface between the computer and the terminal unit.

He was given an interface board with no documentation, and was told that there was a connector missing from the board as well. The logo CSS A-O Rev A is on the board. Dan describes the board as being populated with 12 integrated circuits, nine resistors, 10 capacitors, one voltage regulator, a slide switch, an eight-position DIP switch, and a 5.0688 MHz crystal. U1 is a 74LS155, U2 a 74LS367, U5 and U7 are 74LS244, U3 and U4 are 1489s, U12 is a 1488, U8 is a 74LS00, and U9 is a 74LS04.

Dan is looking for an identification of this board, and, hopefully, some interfacing information. From the interface chips (1488 and 1489) on the board, it certainly sounds like the right interface board, but I come up blank looking for details. Can anyone out there help? Send the information to me here at RTTY Loop, and I will try to forward it to Dan, as well as to the readership at large.

Apple II-e

Here's a note from Byron Schulten NO3X in Cumberland, Maryland, whose question fell to the bottom of a tall stack of mail. Byron is interested in putting his Apple II-e's onto RTTY, with either a Kantronics KAM or an AEA PK-232 RTTY modem. I know of no reason why either setup wouldn't work just fine, Byron. About any good communications software, such as you would use with a modem on a telephone communications service, should work just fine. There may be some specialized packages out there, and a few questions in local user groups or on Apple bulletin boards may be all you need to turn up some reasonably inexpensive solutions. Good luck, and look to hear from you in the future.

RTTY Loop Index

Many of you have requested the RTTY Loop index, and have found hidden treasure in the compiled list of the first 12 years of RTTY Loop. A request and self-addressed, stamped envelope will get you a copy of this compendium. I look forward to your questions, and answers to the survey, either by mail or E-mail. I hang out on CompuServe, ppn 75036, 2501, and Delphi, username MARCWA3AJR. I try to answer E-mail immediately; I have been known to be a bit longer with conventional communications.

April is next month, no foolin'! And with it comes spring, and the desire to see interest in this hobby blossom. I'm proud to say that for many of you, RTTY Loop is where you turn to key into the forefront of amateur technology. Keep that subscription current; with that tease, you wouldn't want to miss April's RTTY Loop. ■

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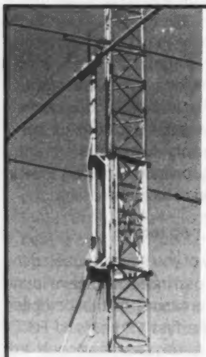

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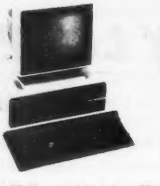

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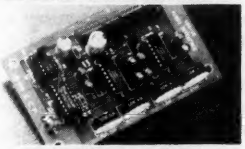

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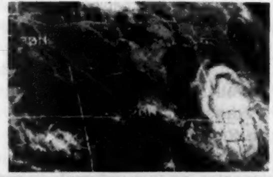

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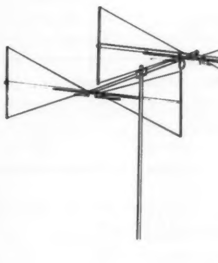

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29 MHz Amplifier

Ten meters does not require huge power. The 10 Watts from my Asden 2800 was a little skimpy, however, so I built a pair of 6146s to follow it. The circuit is very conventional, and I constructed it in a case that once held a battery charger. As long as you are neat in your physical layout, you could build it in almost anything.

The only adjustments that require close attention are input, output, and neutralization. All the rest are one-time, set-and-forget adjustments.

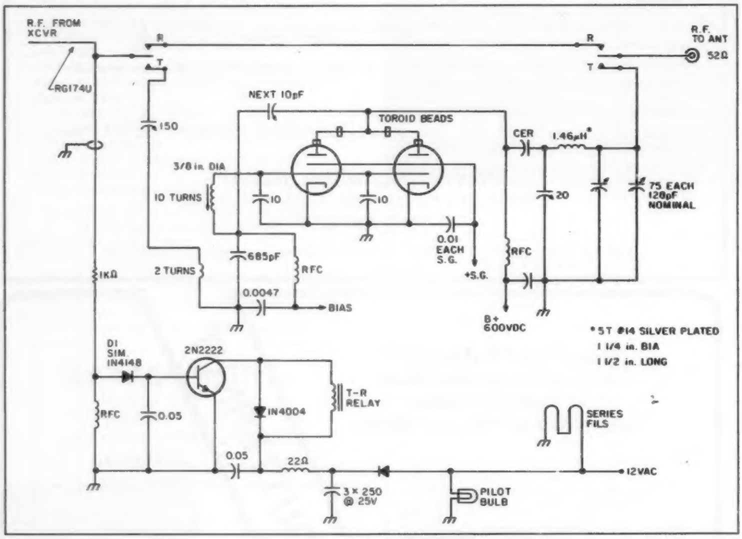
The 150 pF capacitor in the input line compensates for impedance mismatch. You tune for maximum signal transfer from exciter to final. (Use an in-line meter or external field strength meter.)

The final is conventional Pi-network. I used two 75 pF APCs because I had them and they fit well, but a single 150 pF cap would work as well. You need nearly full capacity in either case.

When neutralized, the plate current dip should be at about the same setting of the 20 pF plate capacitor as maximum output. This is often difficult to obtain with tetrodes, but you can usually come close.

Power supply can be whatever you have handy or can build. The one shown used an old TV transformer from an RCA color set of about 1968 vintage. Adjust bias to let tubes idle at about 30 mA. (See Figures 1 and 2.)

Bruce Cameron WA4UZM
Temple Terrace FL


R.F. FROM XCVR
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10 TURNS
10
10
20
75 EACH 120pF NOMINAL
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SERIES FILS
0.05
22Ω
12VAC
3 × 250 @ 25V
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Figure 1. 29 MHz amplifier.

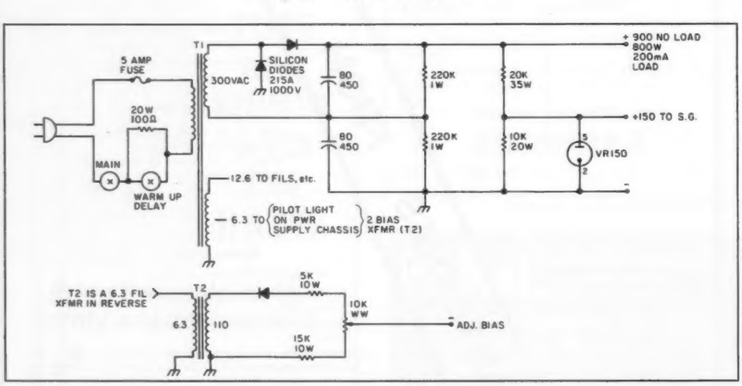
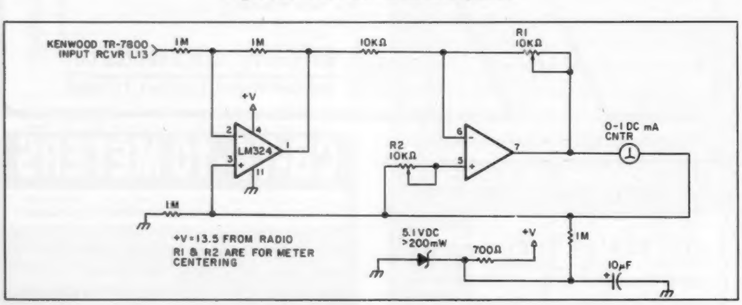

T1
5 AMP FUSE
300VAC
SILICON DIODES 215A 1000V
80 450
220K 1W
20K 35W
+ 900 NO LOAD 800W 200mA LOAD
20W 100Ω
+150 TO S.G.
80 450
220K 1W
10K 20W
5
VR150
2
MAIN
WARM UP DELAY
12.6 TO FILS, etc.
6.3 TO PILOT LIGHT ON PWR SUPPLY CHASSIS
2 BIAS XFMR (T2)
T2 IS A 6.3 FIL XFMR IN REVERSE
T2
6.3
110
5K 10W
10K WW
ADJ. BIAS
15K 10W

Figure 2. PS for the 29 MHz amplifier.

Deviation Meter Circuit

You can use this circuit in most FM VHF receivers. Hookup is off the FM discriminator. I use a three-wire shielded mike wire and a subminiature stereo jack/plug. The plug tip for B+ is from the radio, center for signal, and shield for ground. This makes for a clean installation. I put this circuit into a small box and attached it to the dash of my car, using Velcro. Every signal transmitted has its own deviation signature. This can be a real plus in jammer hunting. You can obtain most parts at Radio Shack. (See Figure 3.)

Also from N6JSX: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R1 10KΩ
+V
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4
LM324
1
3
11
6
7
5
R2 10KΩ
0-1 DC mA CNTR
1M
+V=13.5 FROM RADIO
R1 & R2 ARE FOR METER CENTERING
5.1VDC >200mW
700Ω
+V
1M
10μF

Figure 3. Deviation Meter Circuit.

Automatic PTT Switch

This little circuit for T-hunters lets you set your transmitter to turn on automatically at a speci- fic time. The T-hider can vacate the area and even go to the starting point to watch the confusion!

Set the alarm to the time trip point. Push S1 to hold the PTT open and the relay on. Dead power default is PTT closed. The alarm trips and fires the SCR, which shorts out the relay circuit, drops the relay, and removes voltage.

You need a single cell alarm clock, RS 63-716; KL-DPDT, RS 275-215; SCR, RS 276-1067; S1, RS 275-1571; and ¼ W carbon resistors. (See Figure 4.)

Dale R. Kubichek N6JSX
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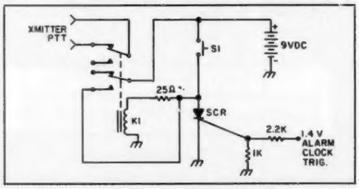
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9VDC
25Ω
K1
SCR
2.2K
1.4 V ALARM CLOCK TRIG.
1K

Figure 4. Automatic PTT Switch.

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Troubleshooting: Finding What Works

I promised way back in my first column to talk about troubleshooting. So here it finally is! Let's get started.

The rig dies and you get out the schematic. One look at all those parts (a lot more than in the "gutless wonder" tube days, eh?) and you head for the shipping box, right? Well, your radio's circuitry doesn't have to be intimidating. It's all a matter of organization.

Ever wonder how anybody designs something as complicated as a modern transceiver? Taken all at once, it just couldn't be done. But any complex circuit can be broken down into sections and subsections, until each one is bite-sized. That's how they're designed, and that's how you should approach them for repair.

Unless the problem is totally obvious, troubleshooting is a process of elimination. The pros find problems very quickly, because they mentally eliminate most of the possibilities before they ever touch the circuit board!

> ***". . . troubleshooting is a process of elimination."***

So, first find what works and eliminate it from consideration. Much of this can be discerned without even opening the rig. Does it light up? Does the frequency display seem to work? If so, the power supply and digital circuits are probably OK. If the receiver is dead, is there any hiss at all coming from the speaker? Put your ear up close and listen. If so, the audio amp should be fine. Turn the volume up and down. If the hiss changes with it, then the detector works, indicating trouble farther up the receiver chain.

An understanding of the organization of the circuit (the local oscillator feeds the mixer, etc.) is essential. For instance, if the rig lights up but the receiver seems dead and the S-meter is pegged, I look first at the AGC amp. I do this because S-meters are driven by the AGC voltage. Ever notice that the meter pegs when you turn the RF gain control down? You're really artificially boosting the AGC.

Which Bit is Broken?

Last month's column discussed the likelihood of part failures, classified by component type. Let's do the same for the sections of a radio.

Power supply: This is the site of more problems than any other. Why? Because it carries the most current and, therefore, the most stress. Always look here first. Are all output voltages correct? While a regulator failure could cause them to be too high, it is much more likely that they will be either about right or zero. If one is zero, it could be due to supply failure or a short in one of the circuits being fed. Disconnect the load from the supply and see if it comes up. If it doesn't, start working backwards until the open part is found. But remember, it could have been blown by a short somewhere else in the rig. Check the resistance of the load while it is disconnected from the supply. It should never be zero ohms.

Switching circuits: These parts, such as diodes and relays, are typically used for TX/RX control. Are the circuits in question getting inputs and, especially, power?

Oscillators: A dead local oscillator will kill the receiver and/or transmitter. I've seen lots of them go out. Check with a scope or VTVM, if it can sense at the required frequency. Always look at the output of the oscillator, as you can stop it from working if you probe at the active element (crystal, coil, etc.). In a synthesized rig, it may be working, but wildly off frequency, indicating PLL trouble.

Power amps: Both RF and audio. These handle large current, so they are also candidates, due to high stresses. Symptoms should be obvious: the amp is dead or severely distorted. First check for input to the amp. Then make sure there is no muting or, in the case of an RF final, ALC voltages keeping it clamped off.

Then, check for bad parts, especially in the output stages, where the stress is. For audio amps, always check the speaker and connections to it, including the earphone jack, before working on the amp.

Front ends and IF strips: If the receiver is dead or weak, the local oscillators are working, and the S-meter reads zero, gain is missing somewhere. Probably a bad transistor or chip.

> ***"A dead local oscillator will kill the receiver and/or transmitter"***

Transmitter intermediate stages: Lack of modulation, distortion, etc. can be caused long before the signal gets to the final amp. Check mike amp, output of balanced modulator (is it there?), and pre-driver stages.

Finally, always remember that sudden changes in performance are **NEVER** caused by misalignment! Somewhere, a part has gone. **DON'T** start turning coils or trimcaps—you will be very sorry later!

Like playing a musical instrument, troubleshooting is a complex skill best learned on the job. The more you do, the better and faster you get!

Let's look at this month's letters:

Dear Kaboom,

My TS-440S has an intermittent rushing noise in receive. When it's there, it reads S-9 on the meter, and blots out everything. When it's not, all is fine. Keying the transmitter for a second sometimes gets rid of it. The noise is there even with no antenna connected. What gives?

Signed,
Rush Job

Dear Rush,

Sounds like TX/RX switching to me. Either a noisy relay or bad diode feeding power to the front end. A poor connection can look like a resistance, causing stages to oscillate due to insufficient bypassing. I'd check relays first. Don't bother with the little bandpass filter relays; they don't switch when you press the key. Look for any that do and clean them. Also, check the solder connections to the board. Relays frequently have cold solder joints because the pins are large and don't get hot enough during the wave-soldering process. The movement of the relays only aggravates the situation. If that doesn't work, look for the oscillating stage (it should be very obvious on a scope) and see where its power comes from. Finally, it could be a problem with the stage itself, such as a flaky transistor or diode.

Dear Kaboom,

My rig is grounded, but I keep getting burned by the mike, especially on 10 and 15 meters. I know I need a shorter ground wire, but there's no way to do it here. Any ideas?

Signed,
Hot Stuff

Dear Hot,

Sure. Try a coaxial ground. Take a piece of coax long enough to reach your ground. If that length is very close to a quarter wavelength of 10 or 15 meters, make it a bit longer. Now, get two 0.1µF ceramic caps, rated to take a few hundred volts, or a kilovolt, if you are using an amp. Connect one cap between the center conductor and the shield on each end of the coax.

Now connect the center conductor to the ground of the rig, and to the ground at the other end. The shield should go only to the caps.

Weatherproof the one on the outside. The RF that attempts to climb back up the shield will be shorted back to the center conductor, and so to ground, through the caps. It sounds weird, but it works! ■

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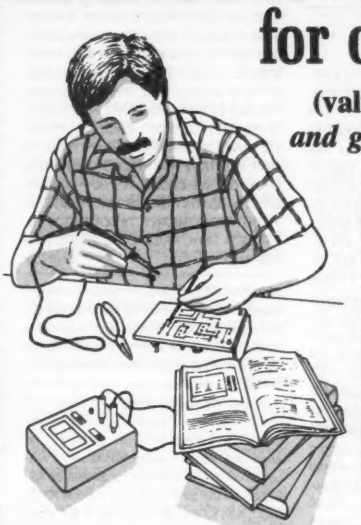

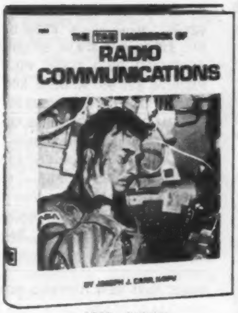
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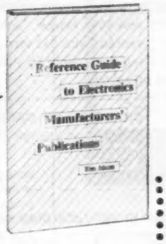
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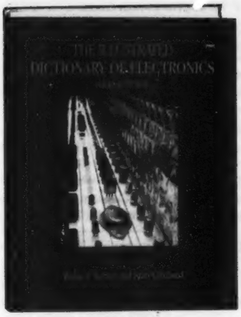
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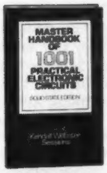
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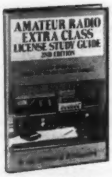
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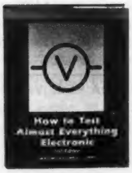
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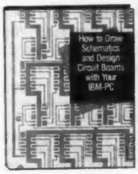
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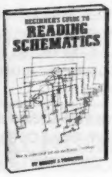
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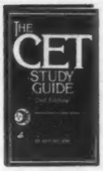
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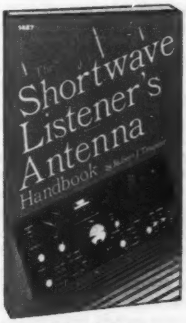
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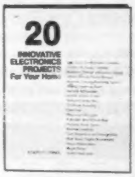
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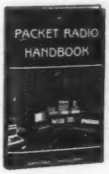
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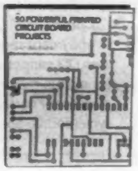
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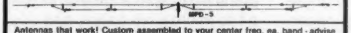

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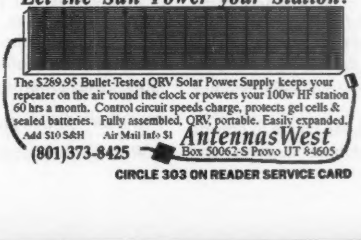

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ABOVE AND BEYOND

VHF and UHF Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

The Winds of Change

With the winds of March come changes and, in this spirit, I have been asked to carry on in this column for Pete Putman KT2B. I wish to thank him for the fine work that he has done, and I hope that I will live up to his expectations in carrying on for him.

I think that some information about my interests and background in amateur radio is in order. I live in San Diego, about 20 miles from the Mexican border and 12 miles from the Pacific ocean. I have written several articles for *73 Magazine* in the past, all of which have been slanted towards improving operation on our VHF/UHF microwave bands and have covered my trademark "Microwave Building Blocks."

> ***". . . made contact over a distance of 495 miles using wideband low-power FM transceivers (on 10 GHz)."***

A Life-Long Interest

I feel very strongly about this subject, and I have been interested in our higher frequency bands for quite a long time. Getting started on these bands and various modes of operation, while keeping things in perspective on the home front, was financially difficult at first. After all, this is "only a hobby," but the desire lingered for an interminable amount of time without fulfillment.

In the '50s and '60s, I converted available military radio equipment, such as the beloved four-channel ARC-4s and ARC-5 VHF radios, to 2 meters for AM operation. Since most of the radios were not complete, I had to construct the other equipment I needed. From this, I guess, grew the seed of my passion for modifying and constructing electronic equipment. It is fulfilling to continue to home-brew some of my gear to complement my commercial equipment.

Though I am not totally home-brew oriented, I do enjoy enhancing my quality commercial equipment, such as my 2 and 6 meter transceivers, with auxiliary equipment. As state-of-the-art circuits have become available, I have become more involved with synthesized, rather than crystal-controlled, equipment. I set up a home lab with the best test equipment I could afford. Much time and effort went into obtaining this equipment, and I had to repair most of the bargain equipment I picked up. That's the price you pay for super bargains.

At the same time, repairing so many different types of equipment was educating. One good lesson it taught me was that without good test equipment, you cannot develop from scratch without paying the price in excessive time spent trying to make something work. Many times I traded my best communications equipment for a special piece of test equipment. But, some of this test equipment is unique and, through several "bargains," I have duplicated the transceiver that I traded for it.

I have been employed by Pacific Bell Telephone for 27 years. Most of my work has been directly involved with microwave radio, data, and video transmission on high capacity systems. In addition, I was also involved with commercial mobile radio systems operating from 30 MHz to 450 MHz. I have, therefore, had my commercial radio license longer than my amateur license. A few years ago, the FCC granted lifetime status to my commercial license.

In this column I hope to provide you with information, ideas, and construction projects. To do this, I'll need for you to inform me of your interests and activities in VHF, microwave, and related subjects. We can create a common ground to exchange ideas and unite amateur groups with similar interests. I would like to see news from UHF microwave groups that I could publish to further our common interests.

Not Just Local Communications

Because of the nature of UHF microwave communications, most people believe they are confined to local communications. True, you cannot make contacts over distances covered by frequencies below 30 MHz, but you can make contacts over quite remarkable distances. For example, during the ARRL 10 GHz contest, Jack N6XQ in Baja California, Mexico, and Gary in Santa Barbara, California, made contact over a distance of 495 miles using wideband, low-power FM transceivers. Through experimentation, Jack discovered a microwave duct that appears to be quite stable. He drove many miles and made many contacts over several months in order to explore and document this duct's properties.

> ***"We are experimenting with using harmonics of 12 GHz to calibrate detectors up on 24 GHz."***

In San Diego, we regularly make contacts with hams in the Los Angeles area, more than 100 miles away. On the West Coast, we are blessed with hills and mountains, from which we can make great line-of-sight (LOS) contacts. But mountain tops are not the only place to exploit. Once, the Italians made a 1,000 mile contact over water. I think we can do similar operations over water in other parts of our country. While it's great to have a high hill in your backyard, it's not necessary for microwave operation. I have heard rumblings of trans-lake communications across the Great Lakes towards Canada.

Plans for "Above and Beyond"

With such possibilities, and Jack N6XQ's successful contacts with Mexico, we have much worth exploring. We need to share information, resources, and ideas for experiments. In future articles, I want to cover the difficulties that we have experienced on the West Coast and in other areas, and the solutions we have tried in order to solve each problem and improve our microwave operation.

Also, I plan to provide supportive information on test equipment and transceivers for most microwave bands from 2 GHz up. The main modes of operation will be wideband FM and narrowband SSB, although I may include others, such as amateur television.

All the currently available surplus test equipment I've examined will not operate higher than 18 GHz. Finding test equipment for 24 GHz is a real problem. At present we are working on methods to test equipment for that band. We are experimenting with using harmonics of 12 GHz to calibrate detectors up on 24 GHz. However, because test equipment for the microwave bands is not always easy to acquire, I will offer projects which you can build with a minimum of test equipment. My goal is to also help you construct a workable microwave transceiver with as little monetary outlay as possible. After all, this is supposed to be fun, not expensive.

Next month I will expand on 10 GHz operation and give you some ideas that you can use to get ready for the ARRL 10 GHz contest that is coming up in about five months.

Let me hear from you. What is going on in your area that is related to microwave bands and operation? Do you have a newsletter you could send me? Let me know if I can publish your address, as I believe this would be a great way to put amateurs in touch with each other. Until next month, 73's . . . de Chuck WB6IGP. ■

Number 23 on your Feedback card

AERIAL VIEW

Antenna News

Arliss N. Thompson W7XU
RR 3, Box 224
Sioux Falls, SD 57106

Troubleshooting

You know the feeling. It's a mixture of disbelief, disappointment and frustration, with a little helplessness tossed in for good measure. It comes when you have spent the better part of the afternoon, or maybe even a few days, working on your latest antenna project. It usually goes something like this:

The sun went down an hour ago and you've just come down off the tower after putting the finishing touches on that new beam. Even though you are tired you run inside to the shack and hook the coax to the rig. Boy, is this going to be great, you think. With this baby, anyone on my frequency within 100 miles that has more that a bobby pin for an antenna is going to have nothing but a puddle of silicon left for a receiver front end. After checking to be sure the frequency is clear, you key the transmitter with a few Watts output, adjusting the sensitivity of your SWR meter for a full-scale reading. You flip the switch to read reflected power, and that's when it hits you. Holy cow! How can that be? The SWR must be 5 to 1! What now?

If you haven't been in a similar situation, you are either new to amateur radio or else you have never erected an antenna more elaborate than a rubber duckie for your hand-held. What separates the men from the boys (or the women from the girls) at this point is how they go about tracking down the cause of their antenna system malfunction.

Start With the Basics

The first thing to do if you find yourself in the above situation is to not panic. Don't, for instance, scramble back up the tower to start changing element lengths as a first step. As with any troubleshooting effort, a systematic approach is generally the best way to go. Bear in mind that when you hear hoofbeats you are more likely to think of horses than zebras. When you begin troubleshooting, rule out the most likely causes of the problem before getting worked up over some complex but highly unlikely source for your difficulties.

Be Realistic

Is there really something wrong with the system, or are your expectations unrealistic? Don't expect the average dipole to give an SWR of less than 2:1 across the entire 80 meter band, for instance. Don't put too much stock in those magazine articles that describe the antenna that is only one third normal size, but gives 8 dB gain and works great off the side, too, and is super for DX and locals both. An antenna system like that is pure fantasy.

Proper Hook-up?

In a similar vein, even with proper expectations, you need to be sure there actually is something wrong with the antenna system. It may seem ridiculous to you as you read this, but more hams than would care to admit have gone off on a wild goose chase searching for a problem that doesn't exist. I'm referring to those of us who at one time or another have found that we had the wrong antenna, or even no antenna, connected to the rig. Others have connected the proper antenna only to see a sky-high SWR that doesn't drop until they finally switch over to the correct frequency band. Of course, neither you nor I have ever done anything so foolish, but simple mistakes do happen and forgetting to check for them can lead to a lot of wasted effort.

Meter Imprecision

It is important to remember that many SWR meters of the "reflectometer" type are quite inaccurate. If you try three of them under otherwise identical conditions, you are apt to get three different SWR readings. So take those readings with a grain of salt. So, first calibrate your "reflectometer" SWR meter. When connected to a dummy load that is matched to the feedline (and the SWR meter), you should see a 1:1 SWR. If not, something is amiss that you should correct before trying to figure out what is wrong with your new antenna.

Check Your Cables!

Faulty coax connectors are one of the most common sources of difficulties in antenna installations, and they are one of the first things to check if problems arise. Poor connections to the shield with nickel-plated PL-259's are a frequent source of headaches for hams. A little care exercised in the assembly of connectors can save a lot of sweat later on. Use your VOM to check for continuity and shorts in the coax while it is on the floor indoors, before antenna erection. And be sure to protect the connectors and coax from the elements with a product like Coax-seal and some electrical tape—water in your coax will ruin it.

Feedline Radiating?

Another thing to check while you are playing with the SWR meter is to see if the SWR changes if you place a short jumper cable between the meter and the antenna. If it does, then any SWR measurements you make will likely be incorrect. The SWR changes you should see with the repositioning of the meter should be a gradual decrease in SWR as you move further from the antenna (this is due to the attenuation inherent to any feedline). The exact values of these changes will be dependent on feedline type and frequency, but they are generally small. Wild swings in SWR with small changes in the feedline indicate that currents are flowing on the outside of the coax, invalidating your SWR readings. The currents may result from an imbalance of current at the antenna feedpoint, or they may be induced to flow on the outside of the feedline braid in cases where the coax comes off at some angle from the antenna other than 90 degrees. The solution may be to place a balun at the antenna or correct some other cause of feeder current imbalance, to dress the feedline so that it runs at right angles from the antenna for as far as possible, or to simply live with the problem. Having balanced feed can be important for maintaining the integrity of a beam's pattern at VHF, but it probably doesn't matter if you have some feedline radiation from your 30-foot high 80-meter dipole. In the latter case, you can disguise (but not actually correct) the problem of a high SWR or difficulty matching by inserting a short length of coax between the transmitter (or transmatch) and the antenna and see how that changes the picture. It's not a very elegant solution, but it frequently works. In some instances, too, improving or modifying the rig's ground system can make a big difference in apparent SWR.

Build It Right?

Let's suppose that you have checked all the obvious possibilities for error or difficulty, and are sure that the problem lies with the antenna itself. There are several things to consider at this point.

First, if you built the antenna from information obtained in a book or magazine article, did you follow the directions exactly? Sure, you can make changes, but some changes are more apt to lead you astray than others. For instance, did you make your beam out of wire instead of aluminum tubing? Or, in the case of VHF and UHF beams, did you use a different size tubing than the one specified? Were the elements in the article tapered while your model used one-piece lengths of tubing for elements? Did you use a conductive boom because it was handy, while the designer of the array used an insulated boom? All of these things can make a substantial difference in antenna dimensions and performance, particularly at the higher frequencies. This is not meant to discourage you from trying your own ideas, or from using what you have on hand, but just be prepared to experience more problems with that route. Unfortunately, with many of these changes, it is very difficult to predict what alterations need to be made to obtain the original's performance, so you are left with cut-and-try methods.

Speaking of following the dimensions published, if you want to achieve equal results with minimal hassle, before you actually get down to cutting aluminum or wire, try to decide if the dimensions given seem reasonable. I received a letter from one ham, for example, who was having difficulty getting a satisfactory match with a small home-brew 2-meter beam. He stated that he had built the antenna exactly as it had been described in the article, and he was even kind enough to send along a copy of the article (a good idea, since I had never seen the article before). I coincidentally had an antenna of similar dimensions and the same matching system, but had had no problems in obtaining a good match. Both antennas used a 1/2-wavelength section of coax connected to serve as a 4:1 balun. The problem was that the formula given in that particular article was incorrect, so when that ham duplicated it exactly, he doomed his project to failure. When I made a balun of the

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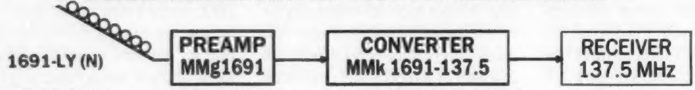

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dimensions described in the article he provided, I couldn't get a good match with my previously functioning antenna, either. The point is to "eyeball" the project before beginning construction to see if the dimensions given seem to make sense. A little experience goes a long way here.

Useful Instruments

Once you have narrowed the problem down to the antenna itself, there are several useful instruments for further defining the problem. One of these is an antenna noise bridge. These are available commercially (Heathkit, Palomar Engineers), or can be home-brewed (described in many *ARRL Handbooks*). The noise bridge allows you to measure the impedance (i.e., both resistance and reactance) of an antenna. These devices contain a wideband noise source and a bridge. When the noise bridge is connected to an antenna and your receiver, you hear the noise generated by the noise bridge. When the bridge controls are properly adjusted there will be a null in the noise heard in the receiver. At that point you can read the antenna's resistance and reactance from the dials on the bridge. If the reactance dial on the noise bridge is already adjusted to zero, you can find the resonant frequency of your antenna by simply tuning your receiver until a null is heard (because the reactance at resonance is, by definition, zero).

One shortcoming of this device is that it measures the impedance at its terminals. If a length of coax is connected between the antenna and the noise bridge, the coax will act as a transformer and hence the noise bridge readings will not necessarily correspond to the conditions at the antenna itself. This can be avoided by using a multiple of ½ wavelength of feedline or otherwise taking the feedline length into account. Another exception is when the antenna is to be matched to the characteristic impedance of the transmission line. While these limitations may seem to be a bit of a nuisance, the noise bridge can be very useful in determining whether your antenna is too long or too short, and can even provide you with an estimate of how much change is needed to move the point of resonance to the desired frequency.

A useful instrument with which many hams are familiar is the grid dip meter. In this era of solid state electronics, its name is a misnomer, but its use is the same. By watching for a dip in the instrument's meter, you can determine the resonant frequency of a circuit. This makes it useful for resonating traps, adjusting the length of mobile antennas to resonance, etc. It is not as flexible as the noise bridge, however, since it shows only the resonant frequency and gives no indication of the actual impedance at a given frequency.

Last but not least—the ohmmeter. An obvious use for it is checking the continuity of connections and connectors. A VOM used in conjunction with a noise bridge and/or grid dip meter should be sufficient instrumentation to troubleshoot the problems with antenna systems most of us are apt to encounter.

Other Trouble Sources

One thing that can be a major problem that many of us can often do little about is the antenna's environment. The antenna's height above ground and its proximity to other objects (trees, guy wires, telephone lines, and even other antennas) can exert a major influence on an antenna's performance. In some instances, this influence may appear to be for the good, such as when resistive losses become high and overwhelm the reactive components at the feedpoint, thereby producing an antenna that is broadbanded but, perhaps unbeknownst to you, lossy. In this case the adage of placing your antennas high and in the clear is sound advice. If you have to erect your antenna in close proximity to other objects, however, you're on your own in optimizing its performance. Each setting is different, and what works in one situation won't necessarily work in another.

Be Systematic

Those are some general suggestions for troubleshooting. It is difficult to be specific without specific cases, but having a systematic approach when troubleshooting is probably your best weapon against Murphy. The general philosophy is quite similar to that taken when troubleshooting a problem with your rig, or even with the family car. In other words, don't jump to conclusions or assume that the worst has happened (it usually hasn't). Instead, start with the most obvious sources of error and difficulty, and work from there.

Good luck! ■

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The problem with commercial broadcasts of weather radar images is that they are not always instantly available, especially during inclement conditions. Amateur TV interfaces with these signals to allow ham-TVers "at will" reception. There are nearly 30 such weather radar interfaces out of 126 known ATV repeater systems in the country. This month's column discusses how to obtain access to these signals and interface with Fast and Slow Scan TV, and gives some information about weather radar signals and systems in general.

Captured Images

The National Weather Service (NWS) has a fleet of weather satellites in operation that take photographs of the Earth's weather from space and transmit these images down to ground receiver stations. These ground stations then broadcast the captured images via FAX on HF and VHF frequencies. Many of you now receive these WEFAX images on shortwave receivers with your computer software programs. One of the most popular of these programs is called COCOFAX (originally called WEFAX) for the Radio Shack TRS-80 Color Computer, written by Martin Goodman (send SASE for details). There are a number of other WEFAX programs available for the Commodore C64/128, Apple, Atari and IBM-compatible computers (see Ralph Taggart's columns in back issues of *73 Magazine*).

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Albany, NY	9	Fort Wayne, IN	15	North Platte, NE	11
Alliance, NE	6	Galveston, TX	9	Oklahoma City, OK	11
Alpena, MI	6	Garden City, KS	8	Omaha, NE	11
Amarillo, TX	7	Grand Island, NE	11	Paducah, KY	12
Apalachicola, FL	10	Goodland, KS	8	Patuxent River, MD	7
Athens, GA	14	Harrisburg, PA	11	Pensacola, FL	11
Atlanta, GA	15	Hartford, CT	8	Phoenix, AZ	2
Atlantic City, NJ	7	Hondo, TX	8	Pittsburg, PA	12
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Baton Rouge, LA	10	Huron, SD	6	Raleigh, NC	11
Beckley, WV	12	Indianapolis, IN	14	Rapid City, SD	4
Billings, MT	1	Jackson, KY	13	Rochester, MN	11
Binghamton, NY	10	Jackson, MS	13	Sacramento, CA	0
Bismark, ND	5	Kansas City, MO	13	San Angelo, TX	9
Bristol, TN	13	Key West, FL	3	San Juan, PR	0
Brownsville, TX	2	Lake Charles, LA	7	Savannah, GA	12
Buffalo, NY	7	Las Vegas, NV	2	Shreveport, LA	11
Burlington, VT	8	Limon, CO	5	Sioux Falls, SD	12
Cape Hatteras, NC	4	Little Rock, AR	10	Slidell, LA	8
Centreville, AL	15	Longview, TX	11	South Bend, IN	14
Charleston, SC	9	Los Angeles, CA	1	Springfield, IL	13
Charleston, WV	13	Louisville, KY	15	Stephenville, TX	13
Charlotte, NC	14	Lubbock, TX	6	St. Louis, MO	12
Chatham, MA	6	Macon, GA	14	Tampa, FL	5
Chattanooga, TN	17	Madison, WI	12	Topeka, KS	10
Cheyenne, WY	6	Marquette, MI	5	Tucson, AZ	1
Cincinnati, OH	17	Marseilles, IL	16	Tupelo, MS	10
Cleveland, OH	13	Memphis, TN	12	Tulsa, OK	10
Columbia, MO	11	Meridian, MS	13	Victoria, TX	8
Columbia, SC	13	Miami, FL	3	Volens, VA	11
Columbus, GA	16	Midland, TX	6	Waco, TX	10
Columbus, OH	16	Minneapolis, MN	8	Waterloo, IA	11
Concordia, KS	12	Missoula, MT	0	Waycross, GA	10
Corpus Christi, TX	5	Mobile, AL	10	West Palm Beach, FL	4
Daytona Beach, FL	4	Moline, IL	13	Wichita, KS	10
Des Moines, IA	15	Monett, MO	12	Wichita Falls, TX	10
Detroit, MI	12	Montgomery, AL	14	Williston, ND	1
Duluth, MN	6	Muskegon, MI	12	Wilmington, NC	7
Erie, PA	10	Nashville, TN	12	Worcester, MA	8
Evansville, IN	11	Neenah, WI	12		

Table 1. Numbers of radars in view of each NWS radar.

> *"Radar has been used to detect precipitation since the early 1950s . . ."*

Popularization of the Weather Signal Image

Radar has been used to detect precipitation since the early 1950s, when radar equipment that had been developed during World War II became commercially available. Radar signals now supply valuable weather information to a wide spectrum of government and private users. Advancements in packaged weather radar signal-to-computer enhanced displays, by commercial companies such as Kavorus, Alden, and others, have given the commercial TV industry a boost in colorful weather newstime presentations. Permission **MUST** be obtained from both the sponsoring TV or radio station and the manufacturing company or its representative before any amateur TV feed can be aired.

NWS Weather Radar Systems

The NWS operates a U.S. network of 128 weather radars (see Figure 1). Nearly all these systems feed the weather radar display images over costly and dedicated phone line circuits. Many TV stations now have "dial-up" outside the local area coverage viewing capabilities. This means the user can take a look at other areas' radar displays across the nation at will. An extensive article about these types of systems, written by Raymond Durand, ran in the August 1988 issue of *Broadcast Engineering*.

Smaller, low-power marine and aviation radars operating at X-band (8,500 MHz to 10,680 MHz) are particularly sensitive to attenuation. The powerful NWS 250 kW to 500 kW C-band (5,250 MHz to 5,925 MHz) and S-band (2,300 MHz to 2,500 MHz and 2,700 MHz to 3,700 MHz) transmitters offer significantly better performances. GOES VHF satellite operation in the 1600 and 137 MHz regions also provide beautiful

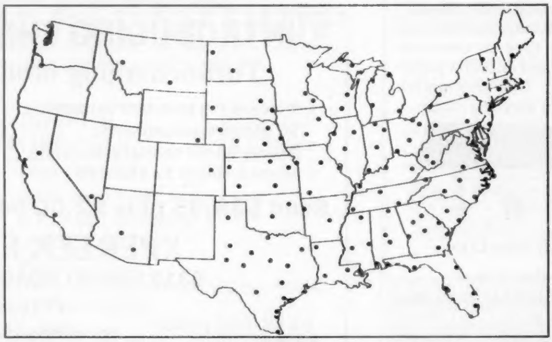

Figure 1. Locations of the NWS radar sites. NWS has allowed direct access by telephone lines to all 128 of its weather radars.

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high-resolution direct images. U.S. Navy NAM broadcasts out of Norfolk, VA on 8.080, 8.027, 10.865, 3.357, 16.410, as well as NPM's Hawaiian 14.822.6 MHz broadcasts, are good places to "tune-in" and pick up WEFAX signals.

Interfacing to ATV

How to get permission for the feed? First go to the TV station that has the radar signal and explain to them the public service benefit of obtaining a feed from them. Get cooperation and a written agreement from both the TV station and the manufacturer and/or distributor of the weather radar equipment. You can reach Kavorus, Inc. at the Federal Aviation Building, 6301 34th Avenue South, Minneapolis, MN, 55450. Their telephone number is (612) 726-9515. I suggest you write rather than call. Use club letterhead stationery. Include a basic block diagram of tap feed interfacing, permission obtained from the local TV station (include a copy of the written agreement) and, most importantly, a statement that the general public will not have access to this feed under any circumstances. Don't forget to stress the public service aim.

Next, find out from the station engineer how to obtain a video tap. Set up an ATV transmitter at the TV site (if no QRM problems exist) or run a link feed from the TV station over to your ATV repeater system's input. 910 MHz seems to be catching on for WX radar TV feeds. PC Electronics of Arcadia, California, and Wyman Research of Waldron, Indiana provide transmitters for such feeds. Paulsen Associates and Bill Olson Electronics provide 910 MHz amplifiers. My January 1989 column discussed how weather radar TV images can be used over ATV and packet radio, and also discussed the use of AX.25 transmitted local county coverage maps.

> ***"The National Weather Service has a fleet of weather satellites in operation that take photographs of the Earth's weather from space . . ."***

Severe Weather Season Approaches!

As we approach spring, such an on-line system will become very useful. An Earwarn-type established group, as described in my January 1989 column, greatly benefits many Amateur and governmental agencies. Such weather radar feeds are not all that complicated to build or interface, and should be an important part of the ATV club or group purpose for the organization. ATV clubs and groups will gain a lot of new members who will at first want to "see" the captured weather radar images, and then later get genuinely interested in the Ham-TV mode itself. Tuning in the WEFAX signals off of a VHF satellite is a challenging and rewarding portion of the Amateur hobby in itself!

Dayton ATV Workshop Sessions

Just a reminder that we will be once again hosting ATVers Workshop Sessions on Friday and Saturday nights this year at the Dayton Hamvention. They will be held at the Ramada Inn North, just off of I-75 and I-70 at the Little York Road exit. We have a number of guest speakers and topics of discussion, plus live and videotaped displays. These sessions have been very well attended in the past few years. It is a great place to meet other Ham-TVers from all across the country! Arrive early and stay late for hours of relaxing, educational entertainment.

Let Us Know

If you have been enjoying these ATV columns for the past 18 months, please drop a card or letter to *73 Magazine* to let us know. Always fill out the Feedback cards when they are provided in the magazine. See you next month! ■

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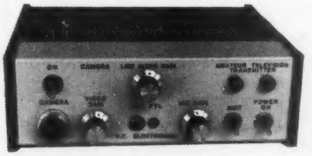

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A maximum of 3 spaces per person (non-transferable). Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. Vendors MUST order registration ticket when ordering flea market spaces.

Special Awards
Nominations are requested for 'Radio Amateur of the Year,' 'Special Achievement' and 'Technical Achievement' awards. Contact: Hamvention Awards Chairman, Box 964, Dayton, OH 45401.

License Exams
Novice thru Extra exams scheduled Saturday and Sunday by appointment only. Send FCC form 610 (Aug. 1985 or later) - with requested elements shown at top of form, copy of present license and check for prevailing ARRL rates (payable to ARRL/VEC) to: Exam Registration, 8830 Windbluff Point, Dayton, OH 45458

1989 Deadlines
Award Nominations: March 15
Lodging: April 7
License Exams: March 26
Advance Registration and banquet:
USA - April 4 Canada - March 31
Flea Market Space:
Spaces will be allocated by the Hamvention committee from all orders recieved prior to February 1. Express Mail *NOT* be necessary! Notification of space assignment will be mailed by March 15, 1989.

Information
General Information: (513) 433-7720
or, Box 2205, Dayton, OH 45401
Lodging Information: (513) 223-2612
(No Reservations By Phone)

Lodging
Please write to **Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton, OH 45402** or refer to our 1988 Hamvention program for lodging information which includes a listing of hotel/motels located in the surrounding areas of Dayton. Reservations for the surrounding area will then become the responsibility of the individual.

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration Form

Dayton Hamvention 1989
Reservation Deadline – USA-April 4, Canada-March 31
Flea Market Reservation Deadline: February 1

Enclose check or money order for amount indicated and send a self addressed stamped envelope.

Please Type or Print your Name and Address clearly.

	How Many		
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(Saturday)	______	@ $7.00	$______
(Sunday)	______	@ $7.00	$______
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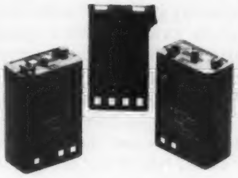

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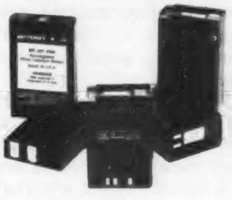

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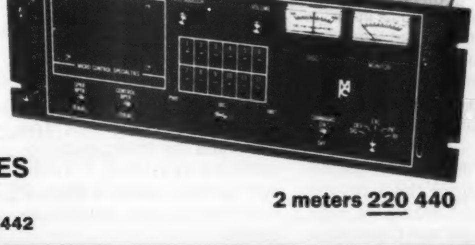

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Ireland

"The Irish have made conversation an art form and the pursuit of it a national pastime," claims the Irish Tourist Board in the opening paragraph of the 32-page brochure they send to all who ask for travel information.

The love of conversation would seem to make hamming an ideal channel for the Irish, yet there are only 2,955 hams in Ireland, or one for every 1,757 residents. On a per-person basis, that's less than one-third as many hams as the US.

Those figures are based on Ireland the island. It is 300 miles long, 150 miles wide, and covers 32,600 square miles, a bit smaller than the state of Maine. Its population of 5,192,000 is slightly more than the population of Wisconsin.

The Irish Tourist Board and many travel books generally consider Ireland as a single unit, but the locals certainly don't look at their lands that way. In 1920 the British Parliament divided Ireland. Northern Ireland chose to remain a part of Great Britain, while the south became the independent Irish Republic.

There's been fighting ever since. The snipings, bombings, and murders have of course become well-known through almost daily reports in our news media. Still, many people are surprised at the number of people killed—2,667—since 1969, when Britain sent soldiers into Northern Ireland to calm the fighting.

Forty Shades of Green

In Fodor's *Ireland*, the popular travel book, the look-the-other-way attitude of much of the outside world is represented in this line: "Come here (to Northern Ireland) and you'll find thoughts of violence vanishing in the face of its outstanding natural beauty and the genuine open hospitality of its inhabitants."

Northern Ireland has 1,568,000 people, about the same as Nebraska; at 5,463 square miles, it is a bit larger than Connecticut. The Irish Republic has a population of 3,624,000, about the same as Kentucky; it covers 27,137 square miles, about the size of West Virginia.

DXers, of course, know that the two Irelands are different, working EI in the Irish Republic, where there are 1,560 hams, and GI in Northern Ireland, which has 2,395 hams. Thus, on a per-resident basis, the less populated Northern Ireland has more than twice as many hams as the Irish Republic.

Despite the fighting, Ireland continues to draw tourists with its diverse attractions. There are more than 200 golf courses, and 28 horse-racing courses. The scenery has "40 shades of green," the Irish Tourist Board claims, adding in language typical of promotional writing that "the landscape is an ever-changing canvas of color and hue." You can see Irish history back to 5,000 B.C., visiting ancient burial sites and centuries-old memorials. There are seventeen museums and galleries in Dublin alone.

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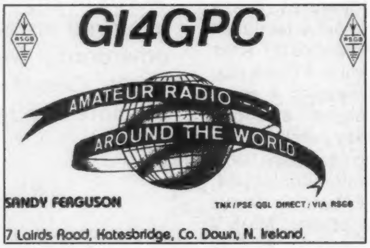
If you're of Irish extraction, you can trace your own history, as Presidents Kennedy and Reagan did, by visiting your homestead and looking up living relatives. You can visit the Gaeltacht, areas where Irish is spoken and the residents continue centuries-old styles of social and cultural traditions. You can shop for Irish products, such as sparkling crystal, soft woolens, luxurious tweeds, fine linens, and handmade pottery.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Guests of the Countess and the Earl

Accommodations are especially attractive. You can stay in very comfortable bed-and-breakfasts for about $14 per person per night. Or you can live like royalty and stay at the Birr Castle, for example, for around $300 a night per person, which includes pre-dinner cocktail, dinner with wine, and a full breakfast.

The Birr is one of Ireland's more than two dozen private castles which accept guests. It was built in the 17th century, and lies on a 100-acre spread with more than 1,000 trees from around the world. The castle is home for Bredan, the Seventh Earl of Rosse, and his wife Alison, Countess of Rosse, who (for a price) "entertain small groups of recommended visitors at elaborate luncheons and dinners."

> ***"Ireland continues to draw tourists with its diverse attractions."***

The Horse-Drawn Caravan

You can travel within Ireland by all the usual means. Railroads are clean, modern, and efficient, and buses serve virtually all of even the smallest villages. Of course, renting a car is most popular.

Then there's the only-in-Ireland method of travel: horse-drawn caravan. It's a covered wagon with bunks for four people, usually with a kitchen, and storage, especially for the oats and hay for the horse. The caravans don't have a toilet. You're supposed to rely on facilities at the homes of friendly farmers along the way. You travel only five miles a day, "three to four horse hours per day," as one handout puts it. That gives you time to appreciate the countryside, to see places and things you would not have otherwise noticed, time to meet people who stop and chat and exchange views on this, that, and the other thing.

"The Dublin Millennium," a celebration of the 1,000th birthday of the capital of the Irish Republic, occurred in 1987. To honor that occasion, 1,000 events were presented. Illustrating the diversity of the celebration, on November 19 our West Point Academy and our Boston College played American football in Dublin. This was only the second major intercollegiate game with America outside the United States.

Sayings and Legends

One of the major fascinations in visiting Ireland is listening to the colorful Irish sayings: "You've been to an Irish wedding" means you've got a black eye. "Have some Irish apricots" refers to potatoes. "You're getting your Irish up" means you're getting angry. "Irish bull" describes statements which seem to make sense, but actually don't, such as: "It was hereditary in his family to have no children."

Legends are almost a major industry in Ireland. One of the most widely known is the story that snakes cannot live in Ireland, that they die even if brought close to the island. The truth is that there are no snakes *native* to Ireland. But that's not distinctive: There are also no snakes native to Hawaii, Iceland, and many other islands. Still, there are snakes in Ireland now and then, brought in by locals or tourists, some apparently trying to rewrite history.

But it is the legend of Ireland's "Blarney Stone" which should be most powerful in attracting hams, especially rag-chewers. You remember the story—kiss that stone and you'll become skilled in "the gift of gab." ■

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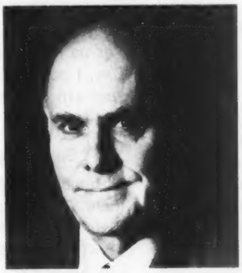

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QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

This month we'll look at some letters from the mailbag. We'll also take a quick look at some homemade gear. We build a lot of radio gear—one point that separates us from the majority.

QRP Equipment

Perhaps the most common questions are: "I want to start operating QRP. How do I get involved? Should I buy commercial or home-brew?" Often times our readers are disappointed because the performance (power out aside) of some commercial QRP gear really falls short of that of most 100-watt out rigs. Remember that running QRP means operating at low RF power levels. Even if you have a rig that puts out a max of 100 Watts, if you can crank the RF power level down to 10 Watts out or less, that rig can be a QRP rig!

Somewhere down the road, QRP got a bad rap for inferior gear. Because of the low power levels, many circuits are simple, but simple circuits do not imply inferior design.

Useful QRP Info Sources

Dennis NE4O asks for sources of information on QRP operation. Well, Dennis, you hold in your hands a great source of QRP construction, building, and operation. Hams really do build, and they're always looking for simple construction projects, which you'll find here, in *73 Magazine*.

Aside from this column, there are three more sources for the QRP addict. The largest journal for the QRPer is the *QRP Quarterly*. New members can join for $10 US and $12 DX. Once you've joined, you're a member for life (unless you drop out of sight for a while; then you can renew your membership for the same price). You'll receive a QRP ARCI number, which will be useful during the many contests the club sponsors. Considering the wealth of information you'll receive, membership is a great value. Write to *Bill Harding K4AHK, 10923 Carters Oak Way, Burke, VA 22015.*

Have you ever enjoyed something just because it is simple, with clean logic? If so, you'll fall for the Michigan QRP club and *The Five Watter. The Five Watter* is published by the Michigan QRP Club in March, June, September, and December. It serves as an informative newsletter to its members. The products, projects, features, and fantasies described are solely for the delight of the readers. In short, you just can't help enjoying every minute you spend reading *TFW*. Dues will set you back $7 the first year. After that, dues are $5 a year. Now that's cheap, considering the postage increase last year. Drop a line to *Tom Root WB8UUJ, 538 Leland Street, Flushing, MI 48433* for more information about the club. Tell him you read about it here.

Let's not forget SPRAT from the G-QRP club. A delight for the builder. Chock full of projects. Since I don't know how to convert English pounds to dollars, I'll stick my neck out a bit on this one. Dues have increased, but because of the value of the Sterling against the US dollar, they have been able to retain the $10 rate for overseas members. However, because of the charge during bank conversion to Sterling, make your check for $12 and send it to *George Dobbs G3RJV, 498 Manchester Road, Rochdale, Lance, ENGLAND OL11 3HE.*

Those of you who have been following this column for the past few years will notice that I've mentioned these sources several times before. I continue to receive requests for clubs and newsletters for the QRP operator.

220 Volt Power Supply

Let's reach in and pull out another letter from the mailbag. Al W6JHO writes asking for 220 volt power supplies for the Ten-Tec Century 22. Al will be going overseas, and the only source of commercial power will be 220 volt AC.

Ten-Tec makes a 220 volt AC version of the power supply for the Century 22. Of course, you can always brew one up yourself, or purchase a third-party power supply.

Now, I have a question for you. I remember reading somewhere about a modification for the Ten-Tec Century 21. This mod would allow you to operate the radio from an external 12 volt source. For the life of me, I can't place where I read that. Does anyone know what I'm talking about, or have a copy of the modification? Sure would be nice to have it in my files. Seems every year around Field Day, I get a dozen requests for such a modification to the Century 21.

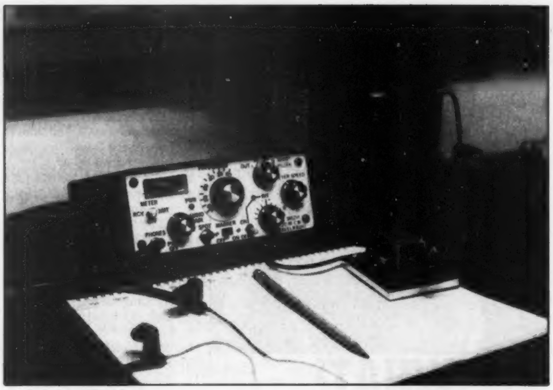

Photo A. Pete Hoover's version of the travel radio. Notice the gell cell batteries and the novel key paddles.

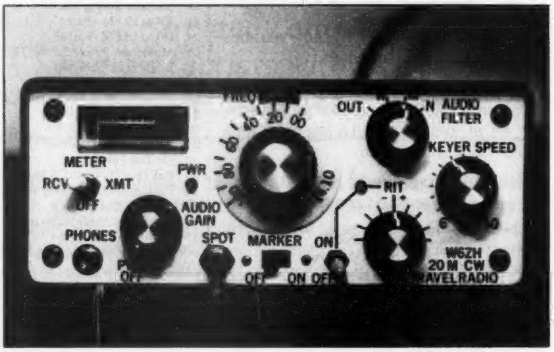

Photo B. Closeup of the front panel of the travel radio. The travel radio was designed by K1BQT.

The "Super Argonaut"

Rumors, rumors, and more rumors. For the past few years, rumors have been flying about that Ten-Tec will come out with a "Super Argonaut." Last year at the Dayton Hamvention, I talked with Sid Kitrell, vice president of marketing for Ten-Tec. Basically, they would like to come out with something super, but the engineering costs would be difficult to recover. In short, there are not enough QRPers that will drop a kilobuck on a 5 Watt radio. That killed the rumors for a while, but they soon returned. This time, Ten-Tec would make a few hundred Argonaut 515s. I called Ten-Tec. No run of the 515 was planned. Back to waiting and hoping.

Now I hear that Ten-Tec will introduce a new QRP radio at Dayton this year. Again, let me caution you. I don't have a firm yes or no from Ten-Tec on this. My source tells me that the new radio will be a low-powered version of the Paragon, with a retail price of about $1,000. Receiver performance will be number one on the list of priorities. Other features include Phase Locked Loop signal conversion, combined with an analog VFO, digital read-out, a host of filters, and most of the extras of the imported radios. I can't wait for April!

Two-Fer 10 Meters

Moving down to the other end of the price list, has anyone put a Two-Fer on 10 meters? With 10 getting hot, I've had many requests for such information. I've never tried to get the Two-Fer on 10, but I know it could be done with a bit of work. To convert the Two-Fer, the oscillator would have to be changed. The output filters, of course, would have to be changed for 10 meters. Would anyone like to give it a try, and then share your results with us?

Dayton Hamvention '89

The Dayton Hamvention '89 is upon us. For the past few years, I've given some details on hous-

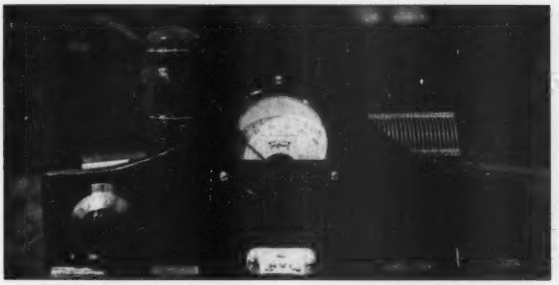

Photo C. The 6L6 Special strikes again! Just when you thought it was safe to go back to transistors. This version was built by Dennis Zona K1VSG.

Photo D. Rear view of the special. Notice the copper "ground" on the wood frame. Nice job, Dennis.

ing and events. This year, I was not able to get hard info for this by the time I had to have this column in to editorial. I must assume that housing will be the same as last year. Look up the QRP column from last March. With a bit of luck, there will be no trouble. I do know that we will be having a QRP forum, dinner, and a super good time at Dayton this year. If you have been there before, you know what I mean.

Special Projects

Last May 1987, I did the 6L6 Special. That project sure did a lot for the builders out there. One of the best-looking Specials came from Dennis Zonia K1VSG. Dennis built it as a ham might have in 1938, using a wood "chassis" lined with copper flashing for a common ground. Dennis writes that without the help of his ham friends, the project may not have been done. Many of the parts came from attics, cellars, and junk boxes from all over. That same pride and satisfaction derived after each 5 watt QSO means the same in 1989 as it did in 1939 a half century ago.

On a more modern note, Peter Hoover III W6ZH sent me his version of the K1BQT "travel radio," designed for the 20 meter band. Pete is having a hard time logging all the DX he has been working. This is a fine example of craftsmanship on Pete's part.

It's Your Column

If you would like to have your handiwork spotlighted, just send it to me and I'll do the rest. Remember, this is your column. I can always use photos. Black and white photos are best. Sorry, no instant photos, they just don't reproduce well.

Next month we'll look at power amplifiers and how to tame them. With the upswing in sunspots, ham radio is cooking, and QRP is the microwave oven! ■

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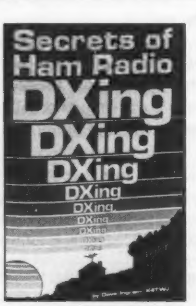

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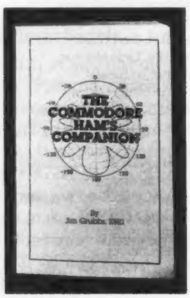

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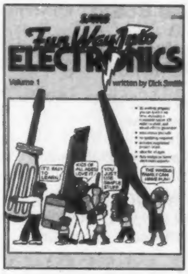

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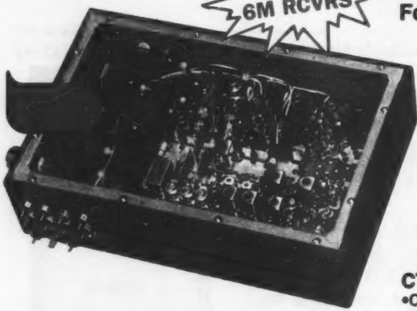

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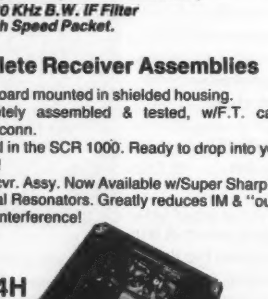

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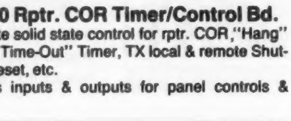

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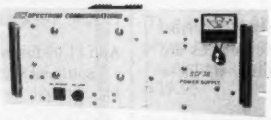

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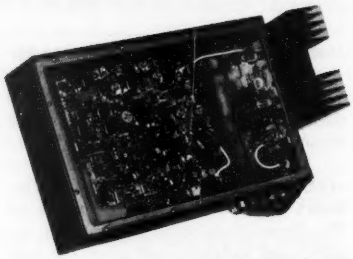

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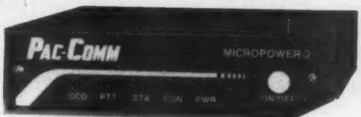

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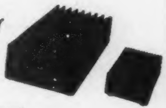

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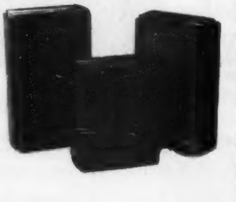

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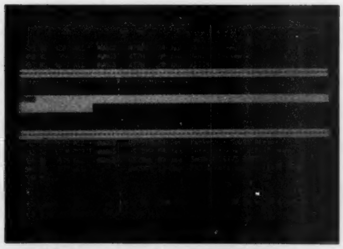

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LETTERS

From the Hamshack

220 Protest

UPS wants 220. UPS is in competition with the United States Postal Service. USPS is "owned" by the same guys who own the FCC. Maybe the FCC gave 220 to UPS so they could not be charged with trying to corner the market.

Don't use UPS. Tell your favorite mail order ham store to send it by snail before using UPS. I believe this is called a boycott.

Robert Godlewski KA4SBE
Ft. Lewis WA 98433

Bob, I can't tell whether you're joking or not. Do you really believe the government fears being charged with "cornering the market" on handling and delivering post? Most people sense that USPS doesn't have as strong a motivation to go after more market share as the private-sector delivery businesses—Uncle Sam assures its existence.

You are absolutely on the money, however, in fighting the reallocation! Hamdom was treated most unfairly here. The issue has many factors, but one thing comes up through the mud—the FCC had to justify money it threw at R & D in the '70s for a mode called narrowband Amplitude Compandored Single Sideband (ACSSB). There were several companies involved in its research, and UPS laid plans to put it to use. UPS claimed they needed a clear 2 MHz chunk of spectrum, and the FCC allocated it in the most expeditious—not the most just—way possible. There are a number of such underused blocks in the spectrum with similar propagation characteristics—including some already allocated to Land Mobile! It was simply less sticky—so they thought—to take away spectrum from hams rather than from other services, or even to assure a clear chunk on existing Land Mobile allocation.

Bob, I'm with you 100%. We must continue our fight to get the reallocation reversed. But it's also time to look ahead. There are still vast amounts of microwave spectrum allocated to the Amateur Radio Service which, with the increasing commercial radio activity on microwave bands, is becoming ever more valuable and sought-after. Unless we start filling these bands with activity pronto, they'll also become the same issue as 220–222 MHz.

So, Bob, continue the fight—and spend time and energy on getting active on 900 MHz and above. Use'em or lose them!

. . . de NS1B

Discouraged

Why do people get discouraged about ham radio? Because they never get started! I looked into it and read everything in the post library I could get my hands on.

I found out that you have to know how to send and copy Morse Code, and you should have a code oscillator and key. I went to Radio Shack and was overlooked while five other customers were helped. I was asked if I knew what I wanted or if my old man gave me a list.

I had read of how friendly, helpful, and willing hams were, so with high hopes I went looking for one. I found a shop that sold amateur radio equipment. They said, "Honey, bring your old man in this weekend and we'll help him right fast." Then I remember a friend said Heathkit had everything. At that shop they said, "Ham radio is not popular. Computers are in." So where else did I look, living on an army post? I checked the MARS station. There I was told, "No female can learn enough to get a ticket."

I went home to do more research, deciding to teach myself. I built the Heathkit oscillator and key, and it worked. I studied the Heathkit learning module. Then I quit for a while, because of illness and of moving to Germany, and because I have been unable to find a ham who would talk to me or help me. I keep hoping to find a ham who will cheerfully help me. I just now, for the first time in two years, found your publication at our local Stars and Stripes. I hope I've shown you one reason why some of us who would be hams are not.

Deborah Chapman, Housewife
USAMMCE
Box 523
APO NY NY 09138

Deborah, although it's true we have a dose of chauvinistic "Good Ol' Boys," there are more and more hams who have open minds and are generous with their time and knowledge.

There are more and more women coming into the ranks. At Dayton last year I saw as many women with callsigns as those who sullenly followed their OMs around, and I hear more and more women on VHF mobile. Perhaps you've heard of the YL (Young Lady) net that meets daily at 0900 UTC on 14.333 MHz? If you have receive capabilities for this band, you may want to listen in on what these women hams have to say. Chances are they've encountered similar problems, and they may discuss their solutions.

Heathkit, by the way, has come back into the ham market full-steam ahead. If the rep you talked to dismissed your interest in ham radio, get on the phone to Heath HQ in Benton Harbor, Michigan and relate this incident. Any rep driving away potential business will be set straight in a hurry!

So, Deborah, don't let narrow-minded sexist condescension stop you from getting involved in a fascinating hobby. If you're truly interested in becoming a ham, I promise you it won't be long before a ham with the proper attitude will come along to help you.

Feel free to give us a call here if you have any more questions (603-525-4201). Let us know, too, when you get your ticket!

. . . de NS1B

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Huge pileups, big city QRN, no spare parts, and a long way to anywhere. You probably couldn't find a better test of the new SB-1400 All-Mode Transceiver than Heath's expedition to Taipei in the Republic of China.

When working DX, you need sensitivity to dig for the weak ones, but still need dynamic range so the guy down the block doesn't clobber you in the middle of a QSO. Sure, the SB-1400 worked the S9 + 30 signals, but out of the pile-ups it also worked a number of stateside stations running 5 watts or less! And that's not bad for a short path distance of 7600 miles!

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73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

It is not too soon to plan a trip to Geneva next October 3–9 for ***"ITU-COM, the First World Summit for Electronic Media."*** *Sponsored by the International Telecommunication Union (ITU), it will be held at the Geneva Exhibition and Congress Centre (PALEXPO), under the theme: "Towards global information: the Electronic Media Explosion." Distinct from the ITU's TELECOM world exhibitions, ITU-COM will be a series of symposia, with one coming every four years.*

The ITU continues to grow (see in the Roundup section, below, under "Italy" and "World"), and further information about it and/or ITU-COM may be requested in French, English, or Spanish, from the Press Service, Public Relations Division, ITU, Place des Nations, CH-1211 Geneva 20, Switzerland.

March calendar of events for QSOs: 1—Heroes Day, Paraguay; 2—Peasants Day, Burma; 3—National Unity Day, Sudan; Independence Day, Morocco (6th for Ghana, 20th for Tunisia, 25th for Greece, 26th for Bangladesh); 6—International Womans Day, USSR; 8—National Day, Syria (10th for Tibet, 12th for Gabon, 13th for Grenada, 31st for Malta); 9—Decoration Day, Liberia; 10—Labor Day, South Korea; 12—Commonwealth Day, Swaziland; 13—Commonwealth Day, Great Britain; 17—St. Pat's Day; 21—Vernal Equinox Day, Japan; 23—Pakistan Day, Pakistan; 26—Easter Sunday; Armed Services Day, Burma; 28—British Evacuation Day, Libya; 29—Youth Day, Taiwan.

Roundup

Italy has signed a "Memorandum of Understanding for the provision of Associate Experts to the development programmes and projects administered through the [International Telecommunication] Union." The signer was His Excellency Mr. Roberto Franceschi, Ambassador and Permanent Representative of Italy to the United Nations and its specialized agencies. The move was additional evidence of Italy's increased involvement with developing countries in order to promote economic, social, and cultural development. Two years ago, Italy contributed US$1 million for the feasibility study of the African Regional Telecommunications Satellite Network (RASCOM). (The **Organization for African Unity**, the OAU, recently made a US$200,000 contribution toward financing this study.)

New Zealand. Des Chapman ZL2VR writes that "What must be, according to my information, **record 50-MHz E-M-E (moonbounce) contacts** took place recently between ZL and the 'States." On September 8th at 1809Z, Graham ZL2BGJ of Waitara on the West Coast of the North Island, had a very successful contact with Jim W6JKV, Los Altos Hills (near San Francisco, California)—a direct distance of 10,000 km. The very next day Graham made an equally successful contact with WA4NJP in Gillsville, northern Georgia (13,000 km) at about the same time of day, although conditions were not quite as good. The WA4 antenna array is not known, but W6 used four 11-element beams in a quad on 15.3m booms, and ZL2BGJ has seven 12-meter towers, and strung between them are six parallelogram rhombics.

Sweden. More DX information to add to last month's report from SM0COP: From *Radio Sweden* Bulletin Nr. 2010: ". . . a conference, organized by shortwave listeners for shortwave listeners, the Swedish DX Parliament is being held June 16–18th, in Morokulien, a joint territory on the Swedish/Norwegian border . . . jointly hosted by the Swedish DX Federation and Norway's DX Listener's Club. There will be workshops, a receiver exhibition, an auction, and undoubtedly a number of radio representatives on hand. For more information, you can write to: Stig Granfeldt, Signalhornsgatan 100, S-654 71 Karlstad, Sweden."

USSR. Earthquake. As of mid-December, several US network news programs had carried brief items about ham radio operators carrying messages, but with no details or IDs. It was too soon, of course, to expect reports to *73 Amateur Radio*, but we hope they will be coming. (See story about Hurricane Gilbert in last month's 73 International.) Rescue and relief operations reportedly were slow; could amateur radio have been quicker in the face of the utter devastation? Radio networks have been developing rapidly across the USSR—as has television: According to Jonathan Sanders in the November *World Monitor*, 93% of the population, all across the 11 time zones of the USSR, has access to Soviet TV.

A correction for last month's "QSL Tidbits from NT2X" box: Valery Tyulyapin's call is RA9YD only. RA3AR was also listed by mistake. **More Tidbits:** A Soviet UDXC DX Club has been formed, with about 128 members. Steep membership requirements: 250 confirmed countries for individual stations, 300 for clubs. QSL Manager is Vlad Zhukov RA3YA, at USSR, 241000, Bryansk, PO Box 73. This year he is mailing his own special multicolor QSL card commemorating 1,000 years of Christianity in Russia. Vlad will appreciate IRCs if you write him anything requiring an answer. *** Victor Tkachenko RB7GG is QSL Manager for the rare UA0KK, UA0ZZ, RD6DZ, UJ8XA, EO5BGH, and RV0YF. He will help with the cards only to W/VE stations—all others please send cards either directly to the stations or via the buro. His address: USSR, 325000 Kherson, PO Box 73. *** Serge UA0KBZ (op. at UZ0KWC), says he has over 25,000 QSL Managers' calls and routes, and would like to put his extensive collection to good use. If anyone needs QSL info on any call, even going back 20 or more years, write him at: USSR, Magadan region, Cape Schmidt, PO Box 485, 68630. Serge would like to exchange info with anyone who has a similar collection; also, he'd like to know if anyone has the DX logs of the late W2CTN. Send IRCs if a reply is requested. [*This is always a good idea!—CCC*]

World. The **International Telecommunication Union (ITU)** continues to grow. **The Kingdom of Bhutan** has become the 165th member, and the **Independent State of Western Samoa** has become the 166th member. Bhutan lies in the eastern Himalayan mountains bordered by the People's Republic of China to the north, and India. Thimphu, the capital, is the location of the Department of Telecommunications. The Bhutan Broadcasting Service broadcasts a daily program in English, Sharchopkha, Dzongkha, and Nepali.

Western Samoa (which became wholly independent in 1962 and is separate from American Samoa, whose residents are American citizens) is in the South Pacific. Its capital is Apia, where the Posts and Telecommunications Department is located.

NEW OR CHANGED QSL INFO ON CHINESE STATIONS(*)
(See p.98, April '88 issue)

Station	PO BOX	CITY
BY1BH	1656	Beijing
BY1BJ	6111	Beijing
BY1CKJ	6207	Beijing
BY4AJT	5221	Shanghai
BY4ALC	4043	Shanghai
BY5HZ	804	Hangzhou
BY5NC	1033	Nanchang
BY7HY	14	Yueyang (Hunan)
BY8AC	(**)	Chengdu

(*) From *The JARL News*, Vol.1 No. 4
(**) 38 Guzhongsi Street

AUSTRALIA

Following is the third and last part of the report sent in by Jim Joyce VK3YJ, which we have entitled "Four Men and an Island—Weather from Beyond the Outback." Part I appeared in the December, 1988, issue and Part II appeared last month.

Amateurs leave their mark on Willis Island. At least three amateurs can be singled out for special mention. Dave VK9ZD (now VK3DHF), one of the Bureau and Radio Technical Officers, came to Willis Island after only five weeks of home life, following a 12-month tour of duty at Macquarie Island—from one extreme in temperature to the other. (He then went back to the ice with two trips to Heard Island as VK0HI.) Dave's QSL Manager is now his father, VK3EVN. Apart from working DX on all bands and notching up some 3,000 QSLs, Dave also followed the hobby of photography, and many off-duty hours were spent exploring his stations and photographing marine and bird life.

Mike VK9ZG (now VK6AMM) followed Dave, and clearly it was amateur radio that passed the time for him. In less than five months on Willis he had made 8,000 entries in his log, mostly of contacts made on 15 and 20, although around 300 were on 6 meters. He used a TS 120S and 3-el Triband TH3 Jr.

Finally, Tony VK9ZH excelled with 10,000 contacts during his

Mike VK9ZG in the Willis Island shack.

Tony VK9ZH was nicknamed "The Laughing One!"

stay. All his logbook information has been transferred to his QSL Manager, Bill VK6YL—who has handled that duty for most of the Willis Island amateurs since 1982.

Willis Island duty may not have been intense, but neither was it (nor is it) casual. Every three hours there are such things to be done as noting cloud conditions, temperature, humidity, visibility, rainfall, and wind direction and speed. Every six hours a balloon flight is tracked by radar and observations plotted. And a Radiosonde flight is done every day, usually in the morning.

Old Willis Island hands will be pleased to learn that the chore of "picking disembodied voices out of the ether" on the station's two-way radio link is soon to be a thing of the past. Under a contract with Telecom, a new "silent" service using telephone circuits relayed by AUSSAT satellite will replace the atmospheric crackles and hisses on the old HF radio transceivers now in use to communicate with the parent Regional Offices.

The new service will provide Willis with voice and data access to anywhere in Australia via Telecom's switched-telephone system. It is known as the Iterra Network, using the Aboriginal word meaning "be quick."

The Bureau decided to use Computer-phones linked to a "Commander" telephone-access system at the location, to satisfy a number of diverse needs. The Computer-phone, developed by Telecom, is a small personal computer with a telephone handset which can be used as a telephone, a data transfer/access medium, or as a stand-alone computer in its own right.

Bill Mahoney (Communications Engineering) says the new system will permit data to be logged automatically–directly into the Bureau's Central Message Switching System (CMSS) at the Head Office. This will ensure rapid dissemination of weather observations on both domestic and international communications circuits—*and* cut down on the incidence of errors.

Radio station VL4OX will remain for backup purposes, of course, so there will continue to be a need for a radio operator on the island. We are fortunate that it has been a practice to encourage the Bureau's radio techs to become amateurs. This is one reason why our rarer Australian DX locations are well down on the most-wanted DXCC list.

SOUTH AFRICA

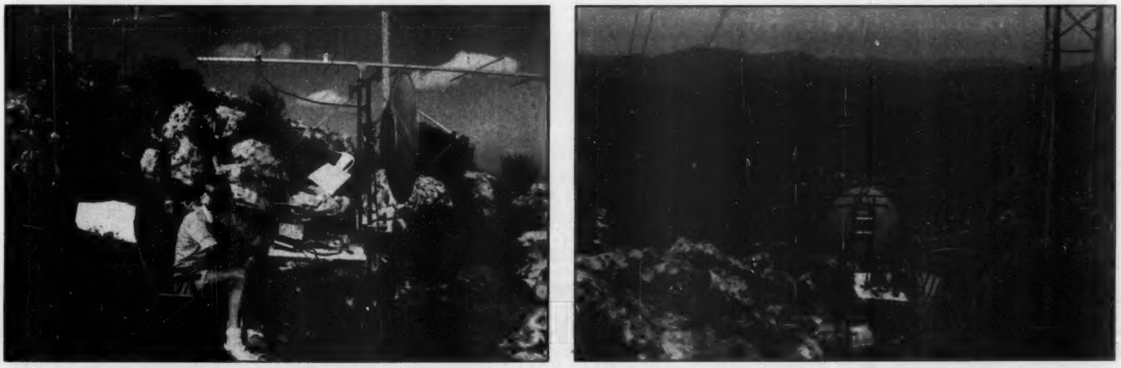
Peter Strauss ZS6ET
PO Box 35461
Northcliff, ZA–2115
Republic of South Africa

Breaking records. A team of South African amateurs broke the Africa record twice for X-band (10-GHz) during 1988. Previously held by the late Gary Howarth ZS6ASO and Dave Woodall ZS6BNT, this 198 km record stood without improvement for many years. Gary Howarth was well known in South Africa for the first 2-meter moon bounce contact and Dave for his leading involvement with the BACAR projects. (BACAR stands for "Balloon Carrying Amateur Radio.") The early records were obtained using wideband i-f until the team of Arnold ZS6KO, Tinus ZS6TL, Julian ZS6AOU, Bill ZS6KO, and Allan ZR6AHL started to use narrow-band modulation. The team was split into two working groups and a path with S9+ signals was made from the site near the South African Broadcasting Corporation transmitter (on the Magalisberg mountains) and a site 211 km away (on the Highlands mountains near Zebediela). That was on August 13, 1988, at 0655Z.

A further attempt by the team over a distance of 252 km with a non-optical pass, due to a 70-meter obstruction, failed on the same day. One of the problems encountered by the team is the lack of suitable long distance sites with non-obstructed paths. Though many sites are available with distances of just around 200 km, access to a suitable site of larger distances is often restricted. In the case of the latest attempt, permission was granted to use a defense force site near the Hoedspruit Air Force base not far from the Kruger National Park.

With satellite TV direct reception virtually unknown, no surplus dishes, receiver modules or i-f strips can be obtained, unless built by the amateurs themselves or imported at great expense. Test equipment in the 10-GHz range is also not easily accessible to the amateurs. These circumstances have held back the development of the 10-GHz band, and only a very few amateurs have tried to make contacts or build equipment.

A bursary for young radio amateurs to study electronics/electrical engineering at a university or technikon in South Africa has been created by the South African Amateur Radio Development



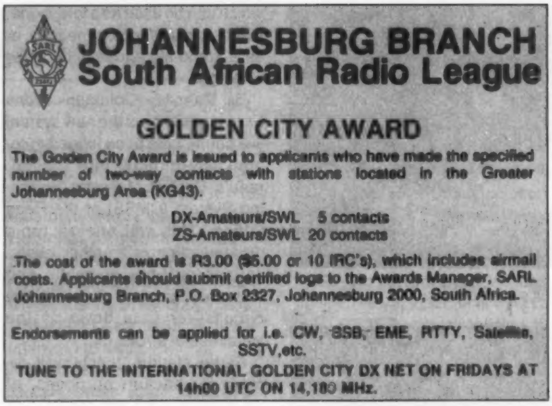
Two views of OM Arnold Mynett ZS6BMS at work. A new Africa 10 GHz record in sight? ZS6BMS is South Africa's IARU VHF WG Coordinator.

Trust. The bursary scheme is intended for first year students in electronics or electrical engineering. Valued at Rand 2500 (about US$1000), the bursary is sponsored by Alcom Systems and will be awarded to suitable applicants entering first years of study. Applicants must be licenced radio amateurs and have a keen interest in electronics.

"We see this as a new challenge for the South African Amateur Radio Development Trust and a major step forward in encouraging young people to take up electronics and radio as a hobby while still at high school," said Professor Pieter Rademeyer, Chairman of the Trust. "We are particularly pleased that Alcom Systems has seen their way clear to sponsor this bursary, as it is important for industry to become involved in the training of manpower."

Although only one bursary is available for 1989, the Trust is involved in fund raising to have more bursaries available in the future.

Three years ago, the South African Amateur Radio Trust was formed to promote amateur radio in South Africa. It was done by a team consisting of amateurs with roots in the SA Radio League. SA AMSAT, the South African Electronics Industry, and South African Universities. "During our short existence, we have already been involved in various student projects at the University of the Witwatersrand (in Johannesburg), University of Pretoria, and Technikon OFS (in Bloemfontein)," Prof. Rademeyer said. "During the past two years we have also sponsored several black students to study for the Radio Amateur Exam (RAE) and were directly involved in the first three Blacks becoming licensed radio amateurs."



JOHANNESBURG BRANCH
South African Radio League

GOLDEN CITY AWARD

The Golden City Award is issued to applicants who have made the specified number of two-way contacts with stations located in the Greater Johannesburg Area (KG43).

DX-Amateurs/SWL 5 contacts
ZS-Amateurs/SWL 20 contacts

The cost of the award is R3.00 ($5.00 or 10 IRC's), which includes airmail costs. Applicants should submit certified logs to the Awards Manager, SARL Johannesburg Branch, P.O. Box 2327, Johannesburg 2000, South Africa.

Endorsements can be applied for i.e. CW, SSB, EME, RTTY, Satellite, SSTV,etc.

TUNE TO THE INTERNATIONAL GOLDEN CITY DX NET ON FRIDAYS AT 14h00 UTC ON 14,180 MHz.

There are no time limits for the Golden City Award.

The South African Amateur Radio Development Trust can be contacted by writing to SAARDT, PO Box 13273, Northmead 1511, South Africa.

Marion Island will be reactivated in April after 10 years of silence, thanks to Peter Sykora ZS6PT who will be traveling there with a meteorological team. He has applied for the callsign ZS8MI (ZS8 is the new prefix for the island). Peter will be a Radio Technician for the 14-month visit and will operate as an amateur when the South African Weather Bureau's communications system is not in official use. He will have HF, 6 meter, and satellite equipment, and access to rhombic antennas.

Updates on the trip will be issued during the Radio RSA's "Amateur Radio Spectrum" program as follows: 1445 UTC to Eastern Europe on 21535 kHz, to Europe and the UK on 21590, to the USA on 25790, and to Africa on 11925 kHz; 1845 UTC to Europe on 15365 and 17795 kHz; and 0245 UTC to the USA and Canada on 9615, 9580, and 11760 kHz.

Further information is available from Nick Moon ZS6BBY and Hans van de Groenendaal, South African Radio League, Johannesburg Branch, PO Box 2327, Johannesburg 2000, South Africa.

Marion Island, access to which is limited now to scientific teams, under a UN treaty, was last heard from in 1977 when Johan Jordaan ZS6BEE operated with the callsign ZS2MI.

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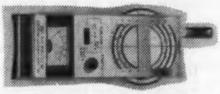

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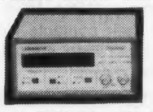

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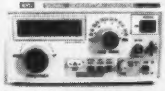

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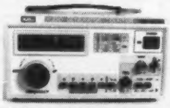

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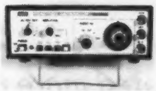

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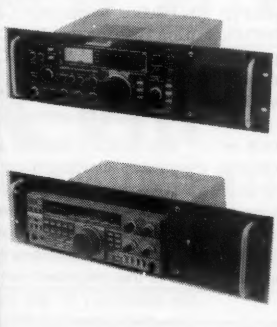

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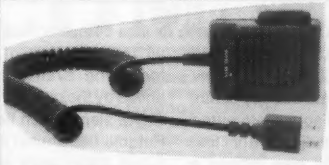

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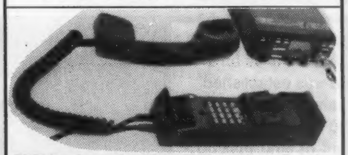

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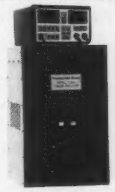

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Rotuma Island—The Next DXCC Country?

About 400 miles north of the capital city of the Fiji Islands lies tiny Rotuma Island, which may well be the next addition to the DXCC list as a separate country. The circumstances that may make Rotuma a new DXCC country may also lead to the designation of other new countries in the Pacific.

Rotuma is situated at least 280 miles from any other island in the Fiji group. It is actually closer to the Solomon Islands and Tuvalu than to its parent group. (That 280-mile figure is very important, as we will shortly see.) Rotuma was first spotted by Europeans in 1791, when Captain Edward Edwards discovered it while searching for the mutineers from the *Bounty*. (The mutineers actually settled on Pitcairn Island, almost 4,000 miles to the east.) Rotuma was annexed to the British crown colony of Fiji in 1881, and thus became part of the country of Fiji when Fiji became independent in 1970.

Separate Country Status

The argument for separate DXCC country status for Rotuma hinges on what appeared to be a minor change in wording in the new DXCC rules approved by the ARRL Board of Directors in January 1988. The country criteria rules governing islands were slightly modified, supposedly to make them clearer, and to avoid the controversy surrounding the Alaska DX Club's efforts to have the Pribolofs approved as a separate DXCC country. In modifying the rule, the DX Advisory Committee opened the door for several new countries in the Pacific.

The modified rule 2(a) states that an island situated more than 225 miles from the shore of the parent group of islands is a separate DXCC country, if the parent group of islands is a separate DXCC country by reason of government. The old rule required a 500-mile separation for country status, and didn't differentiate between islands that were countries by virtue of government or by reason of separation from the parent country, such as Hawaii.

Photo A. Kip Edwards W6SZN, one of the operators of the 3D2XX DXpedition.

This means that if a country is truly independent, any part of that country separated by more than 225 miles of open water can be considered a separate country for DXCC purposes.

> ***"An island situated more than 225 miles from the shore of the parent group of islands is a separate DXCC country."***

Eric Scace K3NA researched Rotuma, and submitted an application for separate country status to the DX Advisory Committee based on his findings. Eric first showed that Fiji was indeed a country by virtue of DXCC Country Criteria Rule 1: a sovereign state by reason of government. Fiji is a member of the United Nations, handles its own diplomatic relations, issues its own currency and stamps, and generally meets all the necessary criteria for an independent state.

Once the status of Fiji as an independent state was established, Eric went on to show that Rotuma was at least 280 miles away from the nearest point of land making up any part of the parent country of Fiji. Through careful study of USA Defense Department charts, backed by mathematical analysis from latitude and longitude, Eric proved that Rotuma was no closer than 285 miles from any part of the main group of islands that comprise the country of Fiji.

The 3D2XX Operation

Based on the modified DXCC country criteria, Rotuma appeared to be an excellent candidate for separate DXCC status. However, no country is added to the DXCC list until an accredited operation takes place from that country. So the next step in adding Rotuma to the DXCC countries list was to get on the air from the remote island.

This turned out to be very difficult, as there are no tourist facilities on the nine-by-three-mile Rotuma, and travel to the island is discouraged. Only relatives of the 3,000 Fijians living on Rotuma can get permission to stay on the island. Eric wrangled an invitation to Rotuma through Ed DeYoung VK8XX, whose wife comes from Rotuma. Ed, who also holds the Fiji callsign 3D2XX, made arrangements for Eric, his friend Toni Zimmer KN3T, and veteran DXpeditioner Kip Edwards W6SZN to travel to Rotuma in October, 1988, and stay for two weeks.

The DXpeditioners had to ship all their equipment, antennas, food, and even drinking water ahead by the monthly supply ship, as the plane which flew them into Rotuma had limited cargo space. Since there were no hotels or tourists homes on Rotuma, the DXpeditioners shared the home of their hosts, slept on the floor as the natives do, and ate the local cuisine.

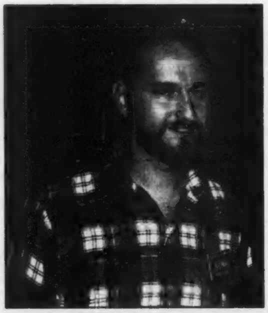

Photo B. Eric Scace K3NA masterminded the Rotuma operation, and wrote the DXAC proposal for separate country status for the island.

Eric and his fellow travelers made all the necessary arrangements, and on October 22, they fired up as 3D2XX from the potential new DXCC country of Rotuma. The operators had announced ahead of time that they disliked the practice of sending partial calls in the pile-ups; they wanted to hear the entire callsign. They also warned against other time-wasting tactics, such as a calling station sending his callsign more than once, asking when the station would be on another band or mode, or stations calling out of turn. Their warnings seem to have been heeded, as the pile-ups were (reasonably) orderly, and DXers had no trouble making contacts on most bands or modes.

The 3D2XX operation netted more than 32,000 QSOs, including more than 8,000 with European DXers, despite the fact that Europe was more than 10,000 miles from Fiji, and the path between them runs straight across the North Pole, always a difficult path for radio contacts. Most of the rest of their contacts were evenly split between stateside and Japanese DXers.

Volunteers from the Northern California DX Foundation, which provided a generous donation to help finance the trip, is handling the QSL cards for the 3D2XX operation. The address for the cards is PO Box 1, Los Altos CA 94023. (Don't use the regular NCDXF address, as it slows the QSL process.)

More DXCC Countries?

Eric Scace's detailed and well-reasoned application for separate DXCC country status for Rotuma is almost certain to be approved by the DX Advisory Committee. But even more interesting for DXers is the precedent set by this: the possibility of still more new countries, based on the modified rule 2(a).

Many islands lie more than 225 miles from their parent DXCC country. Sala-y-Gomez from Easter Island, Malden Island from Kiritimati, Banaba Island from Tawara, the Marquesas from the rest of French Polynesia, Palmerston Atoll from the Cook Islands, and many more. If enterprising DXers can show that the parent DXCC country has separate DXCC status by reason of being an independent country, then islands more than 225 miles away may well qualify as new DXCC countries. Look for more DXpeditions to obscure, out-of-the-way islands in the next few years!

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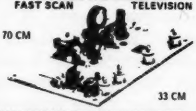

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Photo A. WA6DLQ's control box contains the attenuator control and read-out in the upper right corner, plus an external S-meter, noise meter, and LED-bar meter.

Joe Moell PE K0OV
PO Box 2508
Fullerton CA 92633

Handling Strong Signals

In the last two columns, you've seen how a beam or quad makes a simple, high performance VHF RDF antenna, and how easily you can put one together. But before you're ready to go out and bring home the trophies, you'll need to do a little more work.

At the start of the hunt, the hider's signal may give your receiver only a fraction of a microvolt, but when you get in close, the receiver could get pounded with nearly a volt of RF, even if the hidden T is running low power. The S-meter circuit on your VHF FM rig doesn't have nearly that much range. It probably reaches full scale at 10 microvolts, giving only about 30 dB from minimum to maximum. That's good because it's easy to see the meter peaks when you swing the antenna, but it's bad because the meter will stay pinned when the signal is strong.

Without some sort of low sensitivity receiving system, you may think you're close to the hidden T when you're actually many miles away. You certainly won't be able to get close enough to the hidden T to identify it. That's where the attenuator comes in. This is a device that goes between the antenna and the receiver to reduce the signal level down to within the range that the receiver and its S-meter can handle.

External Attenuators

Attenuator boxes have been around for a long time and have plenty of uses outside of RDF work. For RDF use, connect it in the coax line between the antenna and the transceiver. You can buy nice commercial ones if you have money to burn, or you can readily make your own with ordinary carbon resistors, toggle switches, and a copper-clad board.[1] Most local hunters here in California use these simple step attenuators. There are caveats here, however. You have to remember to switch all sections off before you transmit. If you forget, you may burn out the resistors and put yourself out of the hunt. Also, very strong signals can go around an external attenuator and enter directly through the receiver case or the coax between attenuator and receiver, pinning the S-meter.

There is another kind of easy-to-build external attenuator that uses sliding pieces of brass tubing. It was described a couple of months ago here in *73 Magazine*, and there is also a version in the T-hunt book.[2] Although it can't get cooked if you build it without any matching resistors inside, transmitting through it could ruin your day because it presents a very bad match to your transmitter at some settings. If the rig's high-VSWR shutdown circuit is working OK, there's no problem. But I'd rather risk some burned up resistors than a burned out final amplifier.

The Internal Solution

If you're not afraid to open up your receiver and do some minor augmentation surgery, you can have the best attenuation scheme. It gives full control over sensitivity and you can transmit safely at any time. As a bonus, you'll get more attenuation range than is possible with an external attenuator, because there's no RF leakage problem.

Vince Stagnaro WA6DLQ, a successful local hunter, designed this internal attenuator system, based on earlier work by Peter Bertini K1JZH, Russ Andrews K6BMG, and others. Vince's design is really "deluxe" because it features a rotary control that is calibrated in 10 dB steps. It's fast and easy to use, and the calibrated read-out will help you estimate your relative distance to the hidden T.

You'll need a copy of your receiver schematic before you start. Attenuation is accomplished by reducing the supply voltage on the early RF stages of the receiver. Mods are made only on the DC portions of the circuit, so receiver alignment is not affected. The only connections between the control box and the receiver are the voltage control lead and ground. When you're not hunting, disconnect the control box, and the receiver will operate at full gain.

Install attenuator control transistor Q1 and associated components R1, C1, and C2 on a very small piece of perf board inside the receiver case. Lift the B+ side lead of resistors that are in series with MOSFET drains of the stages to be controlled and connect to the emitter of Q1, as shown in Figure 1.

Vince built his unit for use with a Kenwood TR-7950 transceiver and found that he got best results by breaking the supply line to the RF preamplifier (R7), first mixer (R15), and first IF amplifier (R21) stages. You'll probably find that controlling the same stages on your own receiver will work well. You should not need to control stages beyond the first IF amplifier.

Drain resistors for RF/IF stages are usually in the range of 22 to 100 ohms. Make sure that they supply B+ to both the FET drain and the gate-2 voltage divider, if used. Recent sets such as the TR-7930/7950 and IC-25 are configured this way. The gate-2 divider current does not pass through the drain resistor on some older rigs such as the TS-700A. On those sets, the top of the gate-2 divider resistor pair must also be connected to the controlled voltage line.

Some receivers are different because they have two RF preamplifiers or a passive mixer. Experiment to see which stages need to be controlled on these units. Do not reduce the supply voltage to local oscillator stages. If you have trouble figuring out your receiver schematic, get a local techie ham to help you. Just give a call on a nearby repeater, and they'll probably come out of the woodwork.

Working in today's tiny transceivers can be a bit cramped. Unless you are skilled in the necessary special techniques,

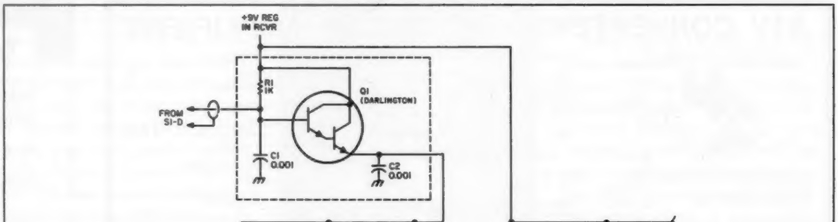

Figure 1. Circuitry in dashed lines is added inside the receiver to control the supply voltage of early stages. Typical stages of modern VHF-FM receivers are shown in block form.

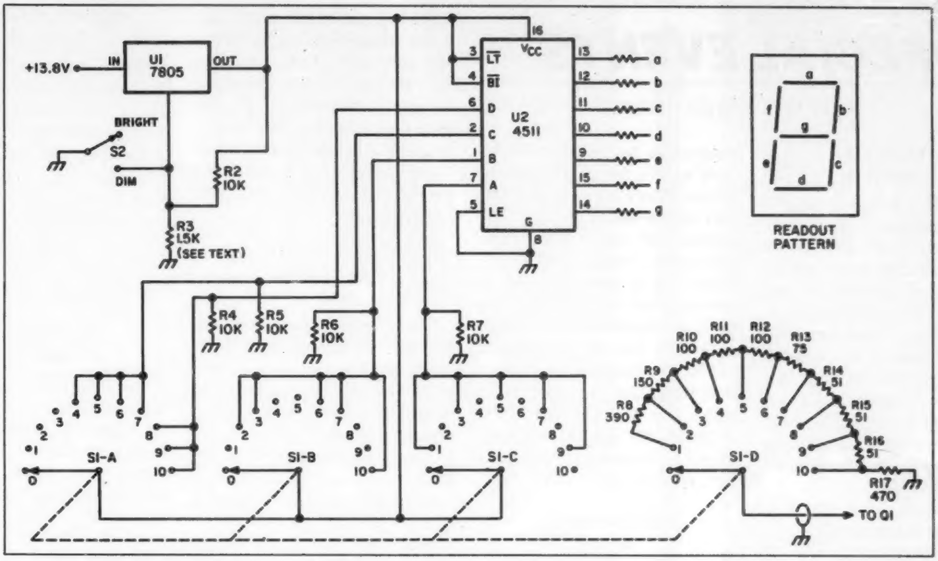

Figure 2. Schematic diagram of the attenuator control unit, which goes in an external box on the dash.

avoid transceivers that use surface-mount components, such as the Kenwood TM-221/321 series and TM-621/721 dual-banders. Remember that the radio will get plenty of shock and vibration in mobile hunting use, so take your time, be neat, and tape all loose wiring carefully to prevent shorts.

Some sets, however, seem to be custom-designed for this kind of modification. The ICOM IC-22U and Clegg FM-DX have one jumper wire that connects B+ voltage to the preamp, first mixer, and first IF stages. Find that jumper and break it, connect the Q1 circuit, and you're in business!

If the hunt rules require closing in on foot, you'll need a field strength meter or a battery-powered, hand-held rig with internal attenuation. You can modify a handie-talkie, but you'll need the hands of a surgeon. A good choice for a rig to modify for this purpose would be one of the older crystal portables, such as the Kenwood TR-2200 or Drake TR-33. They're easy to work on, and you can find inexpensive ones in the used market. Consider deleting the read-out, replacing the rotary switch and fixed resistors with a potentiometer, and mounting the pot inside the rig to make a one-piece, hand-carried "sniffer."

The Control Box

I suggest you build or buy a nice large box (see Photo A) for the attenuator control unit. There are plenty of other T-hunt gadgets, such as a noise meter, remote S-meter, audio S-meter, and DSB detector that you may wish to put inside later. Mount the box firmly to the dash in a position that allows easy reading and viewing, but does not obstruct road vision.

If your transceiver has a multi-pin accessory connector, hooking it to the control box is a snap. Otherwise, drill a hole in the rig to add a connector, or rewire a connector you don't use now, perhaps the external speaker jack. While you're at it, plan ahead and make provisions for wiring in other features you may want to add later, such as the remote S-meter and DSB detector.

All parts in Figure 2 are mounted in the control box. The circuit of S2, R2, and R3 force the output of U1 to be either +12 volts to give bright LED read-out indication for daytime hunts, or +5 volts for dim read-out on hunts at night. Select R3 to give approximately +12.2 volts at U1 output in the BRIGHT position. Power for the control box can come from the cigarette lighter socket.

Rotary switch S1 has eleven positions and four decks, such as Centralab PA1014 (shorting) or PA1015 (non-shorting). Position 0 gives no attenuation (full receiver gain) with the LED read-out blanked. Position 1 gives 10 dB gain reduction and a "1" indication on the read-out, and so on up to position 10, which is 100 dB attenuation and "0" on the read-out.

Q1 is a Motorola MPSA14 Darlington transistor. It's a common part, but if you can't find it, substitute a NTE46 or ECG46 standard replacement transistor. All resistors are quarter-watt parts. The single-digit LED read-out is a common-cathode type, such as Radio Shack 276-077. Values of R8-R17 are for WA6DLQ's TR-7950 installation. If you use a different receiver, try Vince's values first. For the most accurate steps, go through the calibration procedure and determine your own values for R8-R17.

Calibration

To accurately calibrate the internal attenuation system, you'll need a signal generator with variable output on the selected band and an accurate RF attenuator for reference, either built into the signal generator or external. Hook the signal generator through the reference attenuator to the input of your modified receiver. R8-R17 should not be installed at this point. Set the reference attenuator for 100 dB and power up the receiver and attenuator control box.

With the rotary switch on your new internal attenuator set to zero, adjust the signal generator output control for a mid-scale reading on the receiver S-meter. Now set the reference attenuator for 0 dB and turn the rotary switch to position 10 ("0" on the read-out). Select a value for R17 that gives the same mid-scale reading on the receiver S-meter, and solder it in.

Set the external attenuator for 10 dB, turn the rotary switch to position 9 ("9" on the read-out), select a value for R16 that gives the mid-scale S-meter reading, and install it. Next, set the external attenuator for 20 dB, turn the rotary switch to the next position ("8" on the read-out), select a value for R15 that gives the mid-scale S-meter reading, and install. Continue in the same fashion through the rest of the rotary switch positions, ending by selecting R8 to calibrate position 1.

This internal attenuation method works very well with MOSFET or junction-FET RF amplifier stages, used in almost all VHF rigs now being sold. Many older sets use bipolar transistor stages instead of FETs. Voltage reduction doesn't give good results with these rigs, but raising the voltage on the ground side of the transistor emitter resistors usually works well. This technique is described in the T-hunt book.

With your gain antenna, S-metered receiver, and attenuator, you have all the necessities to go hunting on your favorite VHF band. However, there are a number of additional devices that can make you more successful. In the next few months, we'll discuss tricks for antenna polarization selection, antenna mounting, and noise metering. ■

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[1] Moell and Curlee, *TRANSMITTER HUNTING–Radio Direction Finding Simplified,* TAB Books #2701, p. 56. Available from Uncle Wayne's Bookstore.

[2] Cloninger, W.C. "Super Simple Attenuator," *73 Magazine,* January 1989, p. 14.

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SPECIAL EVENTS

Ham Doings Around the World

CAVE CITY KY
MAR 4

The 13th annual Glasgow Swapfest, sponsored by the Mammoth Cave ARC, will be held at the Convention Center from 8 AM until everyone goes home. Admission is $3, tables are $3 each. Forums and an excellent flea market. VE exams will be given with walk-ins welcome. If upgrading, bring original license and a copy. Talk-in on 146.34/.94. Additional information from *N4HCO, 1379 Whites Chapel Road, Glasgow KY 42141.*

HARLINGEN TX
MAR 4–5

The South Texas Amateur Repeater Society is sponsoring its Hamfest at the Casa de Amistad on the above weekend. It will feature FCC and SCT forums, packet demonstration and participation, dealer displays, air-conditioned flea market, VE exams, RACES/ARES meeting, and ARRL forum. Talk-in on 147.99/.39 English; 146.10/.70 Spanish. Admission: advance, $5; door, $6. Tables: advance, $7; door, $10. For registration, contact *Dr. David Woolweaver K5RAV, 2210 S. 77 Sunshine, Harlingen TX 78550. (512) 425-7744.* For VE exams, *Fred Wasielewski, 465 Doherty Ave., San Benito TX 78572. (512) 399-0328.* Flea Market and parking, *Bob Tichenor WD5KBZ, 1522 N. 77 Sunshine, Harlingen TX 78550. (512) 423-6407.*

YORK PA
MAR 5

The Second Annual York Springfest (Ham and Computer) will be at the Dover Firehall. Two floors of indoor tables and free tailgating. Refreshments and prizes. Inside tables, $10. Registration, $4. Unlicensed spouse and under twelve free. VE exams. Parking. General admission 8 AM. Talk-in on 146.37/.97 and 147.93/.33. For advanced information and registration, write or call *York Springfest, PO Box 50, Shrewsbury PA 17361-0050. (301) 239-3878.*

NORTHAMPTON MA
MAR 5

The Mt. Tom Amateur Repeater Association amateur radio and electronics flea market will be held at the Smith Vocational School. Doors will open at 9 AM, with vendor set-up at 7 AM. Admission, $2; under twelve free with adult. Tables, $10 in advance, $12 at door. VEC walk-in exams, check for ARRL VEC for $4.55 and two positive IDs. Talk-in on 146.94, 223.82, and simplex 146.52. For reservations, contact *Bob WB1EQS, (413) 532-6411 days; or Mickey N1CDR, (413)562-1027 evenings.* Or write *MTARA Fleamarket, 6 Laurel Ter., Westfield MA 01085.*

McKEESPORT PA
MAR 5

The Two Rivers Amateur Radio Club is sponsoring its Ham Fest from 8 AM to 3 PM at the Rostraver Fire Hall near Belle Vernon. All indoor tables, dealer area, ample parking, refreshments. Admission is $1 at the door. Full table, $6; half table, $4. Talk-in is on 146.13/.73 WA3PBD/R Repeater. Contact *Louis H. Zimmerman N3GPJ, 911 Roland Road, Wilkins Twp. PA 15221. (412) 351-1562 from 10 AM to 10 PM.*

ST. LOUIS MO
MAR 10

The Jefferson Barracks Amateur Radio Club will hold its 29th annual amateur radio auction at the Concordia Turners Hall. For more information, contact *Cheryl Komor N0GXY, 10400 Meath Drive, St. Louis MO 63123.*

EGG HARBOR CITY NJ
MAR 11

The Shore Points Amateur Radio club invites everyone to its Springfest '89 starting at 9 AM at the Atlantic County 4-H Center. 8000 square feet of heated indoor selling space is available, with outdoor tailgating. Sellers, $5 per space (tables limited); buyers, $3. Talk-in on 146.385/.985 and 146.52 simplex. Write *SPARC, PO Box 142, Absecon NJ 08201.*

INDIANAPOLIS IN
MAR 12

The Indiana Hamfest, sponsored by the Morgan County Repeater Association, will be open to the public at 8 AM at the Indiana State Fairgrounds Pavilion. VEC exams. Admission, $5 at door. Eight-foot tables, $8 each. Advance registration suggested (tables sold out in 1988). Set-up on the 11th from 3–9 PM. Overnight security. Talk-in on 145.25. For table reservations or information, send SASE before February 24 to *Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47403. (812) 339-4446.*

TRENTON NJ
MAR 12

The Delaware Valley Radio Association will sponsor HAMCOMP '89, their 17th annual flea market of radio and computer equipment from 8 AM to 2 PM at the National Guard 112th Field Artillery Armory. Admission is $3 in advance, $4 at door. Indoor selling spaces are $10 (wall space) or $7; outdoor spaces are $6. Sellers must provide their own tables. Doors open at 6 AM for vendors and 8 AM for the public. Talk-in on 146.07–.67. For information and reservations, write to *HAMCOMP '89, c/o KB2ZY, R.D. 1, Box 259, Stockton NJ 08559. SASE please.*

PISCATAWAY NJ
MAR 18–19

The Piscataway ARC will operate their annual special event station from 0000Z to 2400Z each day to Commemorate the WWII operations of the Voice of America Relay station WRCA, which was located in the Bound Brook section of Piscataway. Members will operate under their own callsign plus /VOA. Suggested frequencies: CW—novice portions of the bands; phone, the lower third of the general portion of the bands on 75, 40, 20, and 15 meters and the novice portion of the 10 meter band. For certificate, send #10 or 9x12 SASE for unfolded certificate, with your QSL to the *KO2K callbook address.*

FT. WALTON BEACH FL
MAR 18–19

The Playground Amateur Radio Club will hold the 19th Annual North Florida HAM/SWAPFEST at the Shrine Fairgrounds. Doors open at 8 AM both days. Flea market, commercial exhibits, ARRL, MARS, and QCWA meetings. Banquet Saturday night. Free parking. RV parking $10 with hookups. Talk-in on 146.79/.52. Admission, $3 advance, $4 at door. Tables, $10 for one day, $15 for both days. For more information, write *PARC, PO Box 873, Ft. Walton Beach FL 32548.*

WEST HARTFORD CT
MAR 19

The Insurance City Repeater Club will hold its annual Computer and Amateur Radio Flea Market at the American School for the Deaf. Doors open from 9 AM to 2 PM. Admission is $2. Tables are $10 each. Talk-in on 146.28/.88. Contact *Chuck Motes K1DFS, 22 Woodside Lane, Plainville CT 06062.* Please register early. Tables usually sold out in advance.

MAUMEE OH
MAR 19

The 34th Hamfest/Computer Fair sponsored by the Toledo Mobile Radio Association will be indoors at the Lucas County Recreation Center. Dealer setup 5–9 PM Saturday and 5–8 AM Sunday. Tables, $10 regular or $15 prime. All tables $15 after March 12. Tickets, $3.50 in advance, or $4 at gate. Free parking. Talk-in on 147.87/.27. Contact *Ron Morris WB8ZIM, 28141 Glenwood Rd., Perrysburg OH 43551.*

ELIZABETH KY
MAR 25

The Lincoln Trail Amateur Radio Club's Hamfest Committee will hold the Kentucky State ARRL Convention at the Pritchard Community Center. Activities include ARRL VEC exams, walk-in only, and numerous forums. Dealers and flea market vendors. Admission, $4 advance, $5 at door. Vendor spaces are $5 each, including one table and one chair. Talk-in on 146.52 and 146.38/.98. For advanced tickets and set-up reservations and information on exams, contact *Chuck Strain AA4ZD, PO Box 342, Vine Grove KY 40175. (502) 351-1715. SASE, please.*

KANSAS CITY MO
MAR 31–APR 2

The PHD ARA will sponsor the 1989 Midwest ARRL Convention at the Kansas City Convention Center. The Convention features a complete program of forums and workshops, DX, QCWA, packet, computers, ATV, ARRL, FCC, and many more. 800 commercial booths and swap tables available. Large indoor flea market, tables $10. Preregistration by March 20, $5; $7 at door. Exams (no walk-ins). Write *PHD ARA, PO Box 11, Liberty MO 64068. (816) 781-7313. Enclose SASE for confirmation or information.*

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Rick Woodsome

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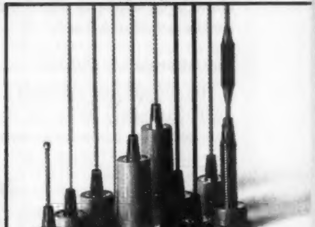
CIRCLE 23 ON READER SERVICE CARD



Number 34 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson AZ 85541

Band conditions in March are usually the best of the year for DX. On top of that, the solar flux will be hitting the highest levels in perhaps 10 years! These *should* make band conditions superb, but we have to take into account the problems associated with the earth's magnetic field.

The greater the solar activity, the greater the possibility of flares, proton events, disappearing filaments, etc. The number of sunspots will be greater than they have been for years. When that happens, the sun becomes less and less predictable. Solar (and earth) storms appear unexpectedly. The best we can do under these conditions is to carefully monitor WWV (10 and 15 MHz AM) at 18 minutes past each hour to get the latest information on happenings for the day, and a resume of the past 24 hours, and forecast for likely conditions during the next 24 hours. This is *valuable* information.

How Not to Succeed

I continue to marvel at the number of hams I hear calling "CQ DX" when there is not one chance in a thousand that a DX station will hear them at that particular time or under those conditions. Here's a synopsis of the use of these charts. First, let's try to understand what happens with the sun and how it affects Earth.

Pay Attention to Old Sol

The sun rotates on its axis a full revolution every 27 to 28 days, and because some solar events persist sometimes for weeks, it is likely that a present condition will return in another 27 to 28 days. Groups of sunspots can exist for a long time, dissipating slowly, with new spot groups forming. The solar plasma is churning and swirling with energy, and beams of subatomic particles spew out into space and hit the Earth. The basic ionization occurs as a result of ultraviolet radiation causing the atoms of air to dissociate into electrons and ions. The ions are not randomly spread about, but, because of the earth's magnetic field, they become concentrated near the poles.

Radio signals refract from the ionized layers and patches in the upper levels of our atmosphere.

In any area on Earth, band conditions will be affected by the conditions of the ionosphere, which in turn are affected by the condition of the sun. The time of year, the time of the month, and the time of day also affect band conditions.

When the sun becomes *too* active, as in a flare, the ionosphere can become over-excited, and radio signals are absorbed instead of refracted or reflected. We've all heard the bands die when a solar flare occurs. However, the ions tend to recombine, rather than stay separated, so new atoms are formed and the process repeats itself. Thus, a major solar event may last for a day or two, with conditions on earth slowly recovering to normal activity.

MUF Chart

WWV announces solar events like flares, so you should be on the lookout for such announcements and plan accordingly. The MUF (maximum usable frequency) depends upon the degree of ionization along the path you hope to send and receive signals. The MUF increases with daylight and decreases with darkness because ionization occurs little, if at all, during the night in the layers we're most interested in. Our tables of country, time, and band, are based upon MUF conditions.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	–	–	–	–	20	–	–	–	–
ARGENTINA	15	20	20	20	40	–	–	–	15	10	10	10
AUSTRALIA	15	20	20	20	20	–	40	20	–	–	–	15
CANAL ZONE	20	20	20	20	40	–	–	15	15	10	10	10
ENGLAND	–	40	80	40	–	–	20	15	15	10	15	20
HAWAII	15	15	20	20	40	40	40	20	20	–	–	10
INDIA	–	–	–	–	–	–	–	–	–	–	–	–
JAPAN	15	20	–	–	–	–	–	20	–	–	–	–
MEXICO	20	20	20	20	40	–	–	15	15	10	10	10
PHILIPPINES	–	–	–	–	–	–	–	20	–	–	–	–
PUERTO RICO	20	20	20	20	40	–	–	15	15	10	10	10
SOUTH AFRICA	20	–	40	–	–	–	–	–	–	10	15	20
U.S.S.R.	–	40	–	–	–	–	–	20	15	20	–	–
WEST COAST	15	20	20	40/80	80	–	–	–	–	15	10	10

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	20	20	–	–	40	20/40	20	–	–	–
ARGENTINA	15	15	20	20	40	40	–	–	–	–	10	10
AUSTRALIA	15	15	20	20	20	–	40/80	40/80	–	–	15	15
CANAL ZONE	10	10	20	40	40	40	–	15	15	10	10	10
ENGLAND	40	40	–	–	–	–	–	20	15	15	15	20
HAWAII	10	15	20	20	40	40	–	20	20	15/20	15	10
INDIA	–	–	–	–	–	–	20	20	–	–	–	–
JAPAN	15	20	20	20	–	–	40	20/40	20	–	–	–
MEXICO	10	10	20	40	40	40	–	15	15	10	10	10
PHILIPPINES	15	15/20	–	–	–	–	–	20	20	–	–	–
PUERTO RICO	10	10	20	40	40	40	–	15	15	10	10	10
SOUTH AFRICA	20	20	–	–	–	–	–	–	15	15	15	15
U.S.S.R.	–	–	–	–	–	–	–	20	15	15	20	–

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	20	40	40	–	–	–	15
ARGENTINA	15	20	20	40	–	–	–	–	–	–	10	10
AUSTRALIA	10	15	20	20	20	–	40	–	20	20	–	15
CANAL ZONE	20	20	20	40	40	–	–	–	15/20	15	10	10
ENGLAND	–	–	–	–	–	–	–	–	20	20*	20*	20
HAWAII	10	15	15	40	40	40	40	40	–	20	20	20
INDIA	–	15	15/20	–	–	–	–	–	20	–	–	–
JAPAN	10	15	15	20	20	20	40	40	–	–	15	15
MEXICO	20	20	20	40	40	–	–	–	15/20	15	10	10
PHILIPPINES	15	15	20	20	20	–	–	–	20	15/20	15/20	15
PUERTO RICO	20	20	20	40	40	–	–	–	15/20	15	10	10
SOUTH AFRICA	20	20	–	–	–	–	–	–	–	–	15	20
U.S.S.R.	–	–	–	–	–	–	–	–	20	–	–	–
EAST COAST	15	20	20	40/80	80	–	–	–	–	15	10	10

Other hours will show lower frequency openings, and then gradually higher frequency openings along a path to another country, as the ionosphere becomes more active and the active level changes height.

Daily Forecast

The daily chart is based on likely occurrences of solar and earth magnetic disturbances. When a disturbance occurs, the earth's magnetic field becomes active and sometimes stormy. The "A" index, which is an overall planetary index of magnetic activity, rises and falls from values close to zero, up to values in the 30s. Zero is a "quiet" field, 10 is an unsettled field, 15 to 20 is an active field, and above 20 the field is stormy.

On days of the week when my predictions indicate that the field will be unsettled to active, I use the letter "F" or "P" and sometimes both, to indicate the trend of conditions. On a "P" day, communications may be impossible on DX paths. On an "F" day, they may be difficult, fair on some and poor on others. On a "G" day, the field will be quiet and communications should be good for DX.

This Month

In March, be particularly attentive to conditions on the 1st and 2nd, the 8th and 9th, the 14th and 15th, and the 26th to the 31st. At these times, or on the days surrounding them, you are likely to experience active to storm-level magnetic field interference, and hence poor DX.

By the way, for those of you who live in Hawaii, or in the northwestern part of North America, Greenland, the Arctic regions, or northeast Asia, there will be a partial eclipse of the sun on March 7.

MARCH

SUN	MON	TUE	WED	THU	FRI	SAT
			1 P	2 P	3 P-F	4 P-F
5 F	6 F-G	7 G	8 F	9 F-P	10 P	11 P-F
12 F-G	13 G	14 F-P	15 P	16 P	17 P-F	18 F
19 F-G	20 G	21 G	22 G-F	23 F	24 G	25 G
26 G-F	27 F	28 P	29 P	30 P	31 P	

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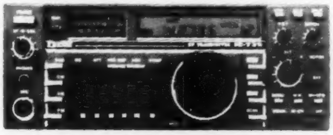

IC-735	List	Jun's
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220 MHz	429.95	249.95
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TM-2550A FM Mobile 45w	519.95	Call $
TM-2570A FM Mobile 70w	623.95	Call $
TH-215A 2m HT Has It All	399.95	Call $
TH25AT 5w Pocket HT NEW	369.95	Call $
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TM-421A Compact FM 35w	469.95	Call $
TH-45AT 5w Pocket HT NEW		
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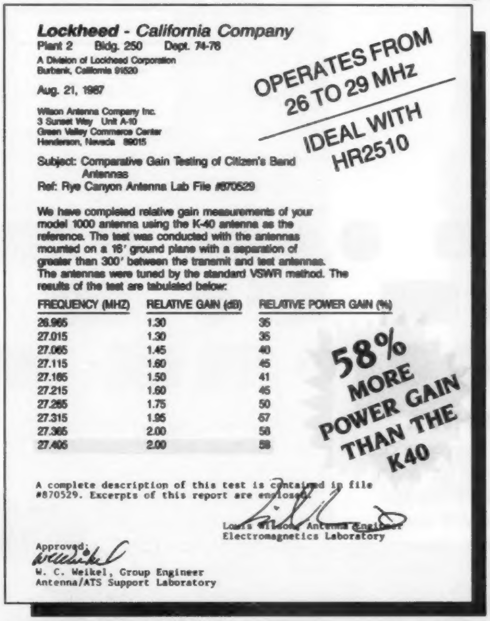
CIRCLE 272 ON READER SERVICE CARD

Wilson
1000

World's Most Powerful CB and Amateur Mobile Antenna*

Lockheed Corp. Test Shows Wilson 1000 CB Antenna Has 58% More Gain Than The K40 Antenna (on channel 40).

In tests conducted by Lockheed Corporation, one of the world's largest Aerospace Companies, at their Rye Canyon Laboratory and Antenna Test Range, the Wilson 1000 was found to have 58% more power gain than the K40 Electronics Company, K40 CB Antenna. This means that the Wilson 1000 gives you 58% more gain on both transmit and receive. Now you can instantly increase your operating range by using a Wilson 1000.



Lockheed - California Company
Plant 2 Bldg. 250 Dept. 74-76
A Division of Lockheed Corporation
Burbank, California 91520

Aug. 21, 1987

Wilson Antenna Company Inc.
3 Sunset Way Unit A-10
Green Valley Commerce Center
Henderson, Nevada 89015

Subject: Comparative Gain Testing of Citizen's Band Antennas
Ref: Rye Canyon Antenna Lab File #870529

We have completed relative gain measurements of your model 1000 antenna using the K-40 antenna as the reference. The test was conducted with the antennas mounted on a 16' ground plane with a separation of greater than 300' between the transmit and test antennas. The antennas were tuned by the standard VSWR method. The results of the test are tabulated below:

FREQUENCY (MHZ)	RELATIVE GAIN (dB)	RELATIVE POWER GAIN (%)
26.965	1.30	35
27.015	1.30	35
27.065	1.45	40
27.115	1.60	45
27.165	1.50	41
27.215	1.60	45
27.265	1.75	50
27.315	1.95	57
27.365	2.00	58
27.405	2.00	58

A complete description of this test is contained in file #870529. Excerpts of this report are enclosed.

Louis Wilson, Antenna Engineer
Electromagnetics Laboratory

Approved:
W. C. Weikel, Group Engineer
Antenna/ATS Support Laboratory

OPERATES FROM 26 TO 29 MHz

IDEAL WITH HR2510

58% MORE POWER GAIN THAN THE K40

Guaranteed To Transmit and Receive Farther Than Any Other Mobile CB Antenna or Your Money Back**

New Design

The Wilson 1000 higher gain performance is a result of new design developments that bring you the most powerful CB base loaded antenna available.

Why Wilson 1000 Performs Better

Many CB antennas lose more than 50% of the power put into them. The power is wasted as heat loss in the plastic inside the coil form and not radiated as radio waves.

We have designed a new coil form which suspends the coil in air and still retains the rigidity needed for support. This new design eliminates 95% of the dielectric losses. We feel that this new design is so unique that we have filed a patent application on it.

In addition, we use 10 Ga. silver plated wire to reduce resistive losses to a minimum.

In order to handle higher power for amateur use, we used the more efficient direct coupling method of matching, rather than the lossy capacitor coupling. With this method the Wilson 1000 will handle 1500 watts of power.

The Best You Can Buy

So far you have read about why the Wilson 1000 performs better, but it is also one of the most rugged antennas you can buy. It is made from high impact thermoplastics with ultraviolet protection. The threaded body mount and coil threads are stainless steel; the whip is tapered 17-7 ph. stainless steel. All of these reasons are why it is the best CB antenna on the market today, and we guarantee to you that it will outperform any CB antenna (K40, Formula 1, you name it) or your money back!

*Inductively base loaded antennas
**Call for details.

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When it comes to power, price and performance, nothing can catch Alinco's DR 510T mobile dual bander.

Forty-five watts on VHF and thirty-five watts on UHF put more power under your dash. And there's nobody else on the road who can match our two-year limited warranty.

The DR 510T gives you cross band/full duplex, 37 standard subaudible tones, encode/decode and an internal duplexer. It also has CAP and MARS modification capability.*

Not to mention all the features needed for a complete home system.

And, as an extra added dimension, it can be modified to operate as a portable repeater.

Take an Alinco DR 510T out for a "test drive". You'll see why it leaves everything else in the dust.

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*Permit required

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CIRCLE 67 ON READER SERVICE CARD

Yaesu's mini HTs. The smallest, smartest, toughest radios. Anywhere.

220MHz
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Whether you're a Novice or Extra class operator, you're sure to appreciate the high power, durability and size of Yaesu's FT-23R Series mini-HTs.

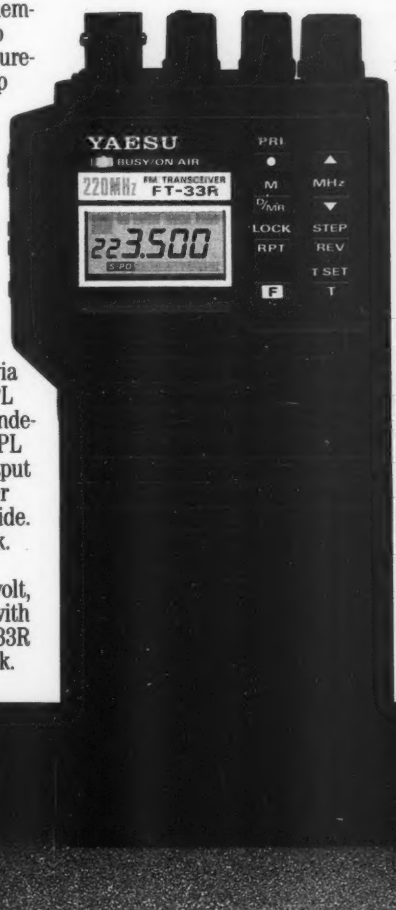
To begin with, you'll find a model that's right on your wavelength. The 2-meter FT-23R. The 220-MHz FT-33R. Or the 440-MHz FT-73R.

Whichever you choose, you benefit from incredibly small packaging. (Take a look at the actual size photo.) Aluminum-alloy cases that prove themselves reliable in a one-meter drop test onto solid concrete. And moisture-resistant seals that really help keep the rain out.

But perhaps best of all, each radio blends sophisticated, microprocessor-controlled performance with surprisingly simple operation. In fact, it takes only minutes to master all these features:

Ten memories that store frequency, offset and PL tone. Memory scan at 2 frequencies per second. Tx offset storage. Priority channel scan. Channel selection via tuning knob or up/down buttons. PL tone board (optional). PL display. Independent PL memory per channel. PL encode and decode. LCD power output and "S"-meter display. Battery-saver circuit. Push-button squelch override. Eight-key control pad. Keypad lock. High/low power switch.

The FT-23R comes with a 7.2-volt, 2.5-watt battery pack. The FT-73R with a 7.2-volt, 2-watt pack. And the FT-33R with a powerful 12-volt, 5-watt pack.



You can choose the miniature 7.2-volt, 2-watt pack shown in the photo below. And all battery packs are interchangeable, too.

And consider these options: Dry cell battery case for 6 AAA-size cells. Dry cell battery case for 6 AA-size cells. DC car adapter/charger. Programmable CTCSS (PL tone) encoder/decoder. DTMF keypad encoder. Mobile hanger bracket. External speaker/microphone. And more.

Check out the FT-23R Series at your Yaesu dealer today. Because although we can tell you about their incredible performance, toughness and small size, seeing is really believing.

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Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. FT-33R shown with optional FNB-9 battery pack.

CIRCLE 165 ON READER SERVICE CARD

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All-mode tri-bander!

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TS-790A

Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as Doppler shift compensation. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio terminal.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:

- **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable

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